Bear River Basin

TMDL Five-Year Review

Hydrologic Unit Codes 16010102, 16010201, 16010202, and 16010204

Final

State of Idaho
Department of Environmental Quality

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Executive Summary

This document presents a 5-year review of the *Bear River/Malad River TMDL Waterbody Assessment and Total Maximum Daily Load* (DEQ 2006a), approved by the United States Environmental Protection Agency (EPA) in 2006. This review complies with Idaho Code §39-3611(7) and addresses the water bodies in the Bear River subbasin that are in Category 4a of the Integrated Report (DEQ 2014a). The current water quality status, pollutant sources, and recent pollution control efforts are described for the Bear River subbasin, located in southeastern Idaho.

Watershed at a Glance

The Bear River basin is a watershed of the Great Salt Lake in Utah and includes over 2,800 miles in southeastern Idaho. In Idaho, the main stem Bear River is 170 miles long while the Malad River is 42 miles long. The Bear River subbasin supports dryland and irrigated agriculture and livestock grazing. Mining was also historically present and some small-scale mining still exists. The 2006 total maximum daily load (TMDL) included water bodies in four hydrologic unit codes (HUCs): Central Bear (HUC 16010102), Bear Lake (HUC 16010201), Middle Bear (HUC 16010202), and Lower Bear/Malad (HUC 16010204) (Figure A).

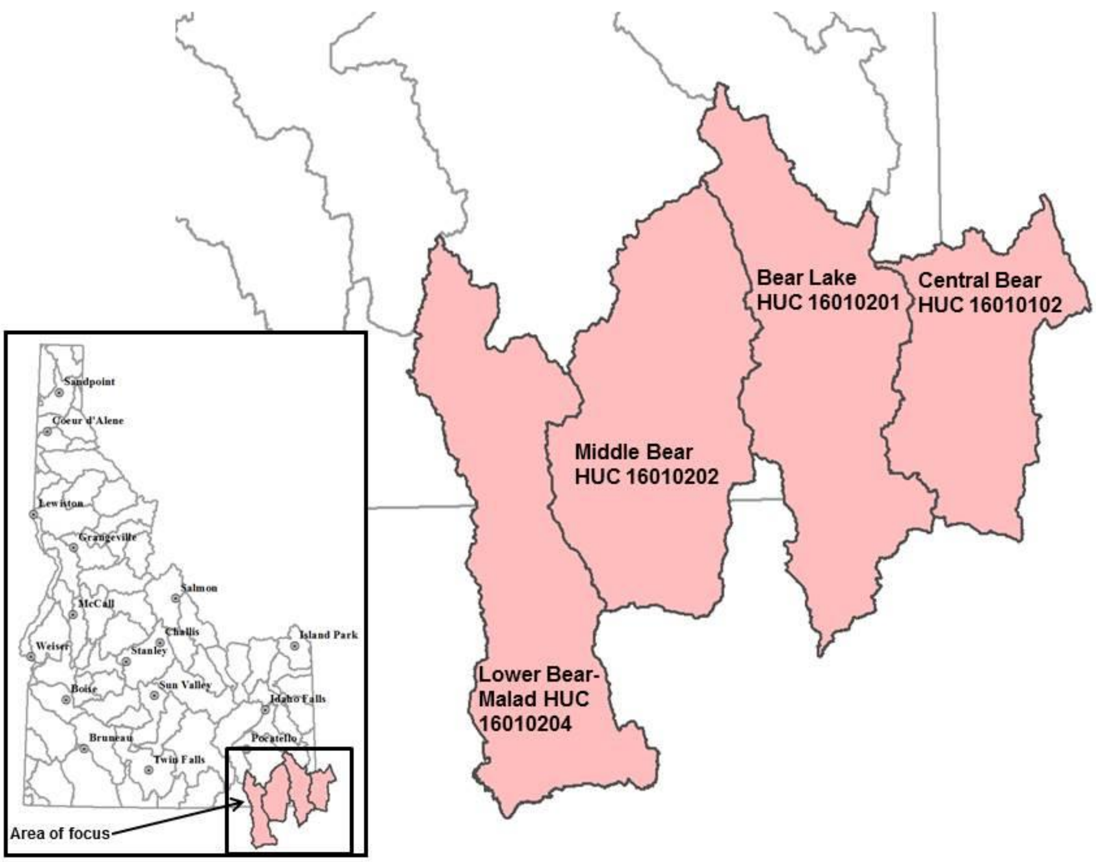


Figure A. Location of HUCs included in the 2006 TMDL (DEQ 2006a).

Table A summarizes the pollutants, approved TMDLs, and associated implementation plans.

Table A. Bear River watershed at a glance.

Approved TMDLs	Pollutants Within Watershed
Alder Creek—total phosphorus, total suspended solids Bailey Creek—total phosphorus, total suspended solids Battle Creek—total phosphorus, total suspended solids Bear River—total phosphorus, total suspended solids Bear River Old Channel—total phosphorus, total suspended solids Burton Creek–total phosphorus, total suspended solids Cottonwood Creek—total phosphorus, total suspended solids Cub River—total phosphorus, total suspended solids Deep Creek (HUC 16010202)—total phosphorus, total suspended solids Deep Creek (HUC 16010204)—total phosphorus, total suspended solids Deep Creek Reservoir (HUC 16010204) Densmore Creek—total phosphorus, total suspended solids Devil Creek—total phosphorus, total suspended solids Eightmile Creek—total phosphorus, total suspended solids Elkhorn Creek—total phosphorus, total suspended solids Fivemile Creek—total phosphorus, total suspended solids Georgetown Creek—total phosphorus, total suspended solids Little Malad River—total phosphorus, total suspended solids Malad River—total phosphorus, total suspended solids Maple Creek—bacteria Mink Creek—total phosphorus, total suspended solids Ovid Creek—total phosphorus, total suspended solids Pearl Creek—total phosphorus, total suspended solids Sheep Creek—total phosphorus, total suspended solids Skinner Creek—total phosphorus, total suspended solids Smith Creek—total phosphorus, total suspended solids Soda Creek—total phosphorus, total suspended solids Stauffer Creek—total phosphorus, total suspended solids Sulphur Canyon Creek—total phosphorus, total suspended solids Thomas Fork—total phosphorus, total suspended solids, total nitrogen Trout Creek—total phosphorus, total suspended solids Whiskey Creek—total phosphorus, total suspended solids Weston Creek—total phosphorus, total suspended solids Williams Creek—total phosphorus, total suspended solids Worm Creek—total phosphorus, total suspended solids Wright Creek—total phosphorus, total suspended solids	Sediment, nutrients, bacteria
Implementation Plans	**Implementation Actions**
Lower Bear/Malad Subbasin (Malad) Agricultural TMDL Implementation Plan (2010) *Central Bear (Bear River Mainstem): Agriculture* (2008) *Northern Middle Bear Implementation Plan: Agriculture* (2008) *Southern Middle Bear Implementation Plan: Agriculture* (2008) *Bear Lake Subbasin TMDL Implementation Plan: Agriculture* (2008) *Bear River & Malad River TMDL Implementation Plan: Forest Service* (2008) *Daniels Watershed TMDL Implementation Plan* (2007) *Cub River Watershed Agricultural TMDL Implementation Plan* (2006)	• PacifiCorp habitat enhancement projects (8–12 annually) and conservation easements • 25 §319 projects initiated since TMDL approval with combined budget of $2,331,634 • Multiple NRCS projects (2009–2015) including 70,676 feet of riparian fencing, 60 off-site water developments, 30,690 feet of channel restoration, 9.276 acres of grazing management, and 1,509 acres of nutrient management

Key Findings

TMDLs subject to 5-year review in the Bear River basin are shown in Table B. Sediment TMDLs were set according to season and the type of receiving water body. During runoff conditions, total suspended sediment (TSS) is not to exceed 80 milligrams per liter (mg/L) in water bodies that drain to streams or rivers or 60 mg/L in water bodies draining to a lake or reservoir. During non-runoff conditions, TSS is not to exceed 60 mg/L in water bodies draining to streams or rivers or 35 mg/L in water bodies draining to a reservoir or lake. Phosphorus was determined to be the nutrient in excess in the majority of water bodies in the basin. Total phosphorus (TP) limits were set according to type of receiving water body and did not vary seasonally. TP is not to exceed 0.075 mg/L in water bodies draining to a stream or river or 0.050 mg/L in water bodies that drain to a reservoir or lake. The Thomas Fork assessment unit (AU) (ID16010102BR003_04) was the only water body that additionally received a limit for total inorganic nitrogen (TIN). In this stream, TIN is not to exceed 0.85 mg/L. Maple Creek (ID16010202BR003_02a and ID16010202BR003_03) in the Cub River watershed received a TMDL for *Escherichia coli* (*E. coli*) set at the state water quality standard of a five sample geometric mean less than 126 colony forming units (cfu)/100 millimeters (mL).

Table B. Existing TMDLs general status.

Assessment Unit Name	Assessment Unit Number	Pollutant	Implementation Plan
Bear River—Idaho-Wyoming border to railroad bridge	ID16010102BR001_05	TP, TSS	Yes
Thomas Fork—Idaho-Wyoming border to mouth	ID16010102BR003_04	TN, TP, TSS	No
Sheep Creek		TP, sedimentation	No
- Source to mouth	ID16010102BR008_02		
- Source to mouth	ID16010102BR008_03		
Alexander Reservoir	ID16010201BR001_0L	TP, TSS	Yes
Sulphur Canyon—Headwaters (Middle and South Forks Sulphur Creek) to mouth	ID16010102BR002_02a	TP, TSS	Yes
Lower Skinner Creek—Above Nounan Road crossing to Bear River	ID16010201BR002_02c	TP, sedimentation	Yes
Bear River—Railroad bridge (T14N, R45E, Sec. 21) to Ovid Creek	ID16010201BR002_05	TP, TSS	Yes
Bear River—Ovid Creek confluence to Alexander Reservoir	ID16010201BR002_06	TP, TSS	Yes
Bailey Creek		TP, TSS	Yes
- Lower: Forest Service boundary to mouth	ID16010201BR003_02		
- Upper: headwaters to Forest Service boundary	ID16010201BR003_02a		
Eightmile Creek		TP, TSS	Yes
- Headwaters to North Fork Wilson Creek	ID16010201BR004_02		
- South Wilson Creek	ID16010201BR004_02a		
- 1 mile below Forest Service boundary to mouth	ID16010201BR004_03		

Assessment Unit Name	Assessment Unit Number	Pollutant	Implementation Plan
- North Fork Wilson Creek to 1-mile below Forest Service boundary	ID16010201BR004_03a		
Pearl Creek			Yes
- Lower	ID16010201BR005_02	TP, TSS	
- Middle	ID16010201BR005_02a		
Stauffer Creek			
- North and South Forks Stauffer Creek and Stauffer Creek to Beaver Creek	ID16010201BR006_02c	TP, TSS	Yes
- Beaver Creek to Spring Creek	ID16010201BR006_02d		
- Lower: Spring Creek to Bear River	ID16010201BR006_03		
North and South Forks Skinner Creek	ID16010201BR007_02a	TP, TSS	Yes
Ovid Creek—confluence of north fork and Mill Creek to mouth	ID16010201BR009_04	TP, TSS	Yes
Georgetown Creek			
- Right-hand fork	ID16010201BR022_02a		Yes
- Upper: headwaters to left-hand fork	ID16010201BR022_02b	TP, TSS	
- Lower: left-hand fork to mouth	ID16010201BR022_03a		
Soda Creek			
- Soda Creek Reservoir to Soda Springs	ID16010201BR023_02a		
- Lower: Soda Springs to Alexander Reservoir	ID16010201BR023_02b	TP, TSS	Yes
- Soda Creek Reservoir	ID16010201BR024_02		
- Source to Soda Creek Reservoir	ID16010201BR025_02		
Cub River			
- Maple Creek to border	ID16010202BR002_04		
- Sugar Creek to US Highway 91 bridge	ID16010202BR003_02		
- Maple Creek: Left Fork Maple Creek to Cub River	ID16010202BR003_02a	TP, TSS, *E. coli*	Yes
- Sugar Creek to Maple Creek	ID16010202BR003_03		
- Maple Creek	ID16010202BR003_03a		
Worm Creek			
- Unnamed tributaries	ID16010202BR005_02	TP, TSS, sedimentation	Yes
- Lower: Glendale Reservoir to border	ID16010202BR005_02b		
Bear River—Oneida Narrows Reservoir to Idaho-Utah border	ID16010202BR006_02	TP, TSS	Yes
Deep Creek	ID16010202BR006_02a	TP, sedimentation	Yes
Bear River—Oneida Narrows Reservoir to Idaho-Utah border	ID16010202BR006_06	TP, TSS	Yes

Assessment Unit Name	Assessment Unit Number	Pollutant	Implementation Plan
Mink Creek			
- Mink and Strawberry Creek: 2nd-order tributaries	ID16010202BR007_02	TP, TSS	Yes
- Source to mouth	ID16010202BR007_03		
Oneida Narrows Reservoir	ID16010202BR008_0L	TP, TSS	Yes
Unnamed tributaries	ID16010202BR009_02	TP, TSS	Yes
Smith Creek—Headwaters to mouth	ID16010202BR009_02a	TP, TSS	Yes
Alder Creek—Headwaters to mouth	ID16010202BR009_02b	TP, TSS	Yes
Burton Creek—Headwaters to mouth	ID16010202BR009_02c	TP, TSS	Yes
Bear River			
- Alexander Reservoir to Densmore Creek	ID16010202BR009_06	TP, TSS	Yes
- Densmore Creek to above Oneida Reservoir	ID16010202BR009_06a		
Williams Creek			
- Source to mouth	ID16010202BR010_02	TP, TSS	Yes
- Forest Service boundary to Bear River	ID16010202BR010_02a		
Trout Creek			
- Source to mouth	ID16010202BR011_02	TP, TSS	Yes
- Source to mouth	ID16010202BR011_03		
Whiskey Creek—Source to mouth	ID16010202BR012_02	TP, TSS	Yes
Densmore Creek—Source to mouth	ID16010202BR013_02	TP, TSS	Yes
Cottonwood Creek—Lower Cottonwood Creek (4th order)	ID16010202BR014_04	TP, TSS	Yes
Battle Creek			
- Upper Battle Creek and unnamed tributaries	ID16010202BR015_02	TP, TSS	Yes
- Source to mouth	ID16010202BR015_03		
- Source to mouth	ID16010202BR015_04		
Fivemile Creek			
- Source to Dayton	ID16010202BR019_02	TP, TSS	Yes
- Dayton to mouth	ID16010202BR019_02a		
Weston Creek			
- Unnamed tributaries	ID16010202BR020_02	TP, TSS	Yes
- Black Canyon	ID16010202BR020_02a		
- Upper Weston Creek: Forest Service boundary to reservoir	ID16010202BR020_02c		
- Headwaters to Forest Service boundary and Trail Hollow	ID16010202BR020_02d		
- Dry Canyon to above Weston City	ID16010202BR020_03		
- Above Weston City to Bear River	ID16010202BR020_04		
Malad River—Little Malad River to Idaho-Utah border	ID16010204BR001_04	TP, TSS	Yes

Assessment Unit Name	Assessment Unit Number	Pollutant	Implementation Plan
Devil Creek—Devil Creek Reservoir Dam to mouth	ID16010204BR002_02	TP, TSS	Yes
Campbell Creek	ID16010204BR002_02a	TP, TSS	Yes
Evans Creek	ID16010204BR002_02c	TP, TSS	Yes
Devil Creek—Devil Creek Reservoir to mouth	ID16010204BR002_03	TP, TSS	Yes
Deep Creek—Deep Creek Reservoir to mouth	ID16010204BR005_03	TP, TSS	Yes
Susan Hollow	ID16010204BR006_02	TP, TSS	Yes
Deep Creek			
- Deep Creek Reservoir	ID16010204BR006_03	TP, TSS	Yes
- Source to upper Deep Creek Reservoir	ID16010204BR007_02		
- Upper Deep Creek Reservoir to Deep Creek Reservoir	ID16010204BR007_03		
Malad River—Mouth and unnamed tributaries to North Fork Canyon	ID16010204BR008_02	TP, TSS	Yes
Elkhorn Creek—Source to mouth	ID16010204BR008_02a	TP, TSS	Yes
Little Malad River			
- Daniels Reservoir Dam to mouth	ID16010204BR008_03	TP, TSS	Yes
- Daniels Reservoir Dam to mouth	ID16010204BR008_04		
Little Malad River—Headwaters to Daniels Reservoir	ID16010204BR009_02	TP, TSS	Yes
Wright Creek			
- Indian Mill Creek	ID16010204BR010_02a	TP, TSS	Yes
- Upper Wright Creek: headwaters to Indian Mill Canyon	ID16010204BR010_02b		
- Middle Wright Creek: Indian Mill Canyon to Dairy Creek	ID16010204BR010_03		
- Lower Wright Creek: Dairy Creek to Daniels Reservoir	ID16010204BR010_04		
Malad River—Source to Little Malad River	ID16010204BR012_02	TP, TSS	Yes

Notes: total phosphorus (TP), total nitrogen (TN), total suspended solids (TSS), *Escherichia coli (E. coli)*

The Bear River/Malad River TMDL (DEQ 2006a) has been the focus of many implementation plans. Implementation plans for agriculture have been developed for the Bear River in the Central Bear subbasin (HUC 16010102), Bear Lake subbasin (HUC 16010201), Northern Middle Bear subbasin (HUC 16010202) above Oneida Reservoir, Southern Middle Bear subbasin (HUC 16010202) below Oneida Reservoir, Cub River watershed in the Middle Bear (HUC 16010202), Daniels watershed in the upper portion of the Malad subbasin (HUC 16010204), and Lower Bear/Malad subbasin (HUC 16010204). Additionally, the United States Forest Service (USFS) developed an implementation plan for lands within their jurisdiction under the TMDL.

PacifiCorp operates the Bear River Project in Caribou and Franklin Counties that consists of three developments: Soda Development (103-foot high concrete dam that impounds the Bear River at Alexander Reservoir), Grace Development (51-foot high timber crib dam that impounds 250 acres in the Grace forebay), and Oneida Development (111-foot high concrete dam that creates Oneida Reservoir). The Federal Energy Regulatory Commission approved a Settlement Agreement in 2003 relicensing the Bear River Project for 30 years. The Environmental Coordination Committee (ECC) is a stakeholder group of signatories to the agreement that consults and decides on the use of funding and other license requirements of the Bear River Project.

The new license requires the provisions of recreation enhancements, minimum instream flows to benefit aquatic resources, funds to conserve and benefit natural resources within a defined action area, and other measures related to land management, protection of cultural resources, and restoration of Bonneville Cutthroat Trout (BCT). As part of the Settlement Agreement, a fourth hydroelectric power plant, Cove, was decommissioned in 2006. The ECC has helped fund 8 to 12 habitat enhancement projects annually, and land has been conserved through easements and purchases.

Many §319 projects have been completed in the Bear River basin since TMDL approval. More are ongoing. The objectives of individual projects have varied but many have focused on reducing in-channel erosion by stabilizing erosive streambanks, planting riparian vegetation, excluding livestock from riparian areas, and relocating AFOs away from waterways. Other projects have sought to increase connectivity for BCT in the subbasin by screening irrigation diversions and removing fish barriers. Some projects have also installed sediment basins in fields to reduce sediment to streams.

In summer 2015, the Idaho Department of Environmental Quality (DEQ) sampled 105 miles of the main stem Bear River with a riverbank erosive index. An interval camera was mounted to the bow of a canoe and set to take photos at 1-minute intervals. Image analysis revealed that the Gentile Valley reach of the river between Grace and Oneida Reservoir had the most degraded channel conditions of the Bear River in Idaho. The river reach was characterized by lack of woody riparian vegetation and in-channel wood and a high prevalence of uncovered and unstable banks. In contrast, the Nounan Valley river reach from the Bear Lake Outlet Canal to Alexander Reservoir contained the best channel conditions in Idaho. This river reach was characterized by an abundance of woody riparian vegetation, mainly willows and hawthorn trees. The proportion of uncovered and unstable river banks was the lowest in this section of river. Below Oneida Reservoir to the Idaho-Utah border, the river is characterized by a thick border of invasive Russian olive trees. Below Oneida Reservoir, the prevalence of uncovered and unstable banks increases downstream.

DEQ has been sampling the Bear River at 21 locations along its length in Wyoming, Utah, and Idaho since 2006. Synoptic sampling occurs four times per year and is intended to capture four hydrologic periods: lower basin runoff, upper basin runoff, summer base flow, and winter base flow. Water quality is best during winter base flow. Overall, Bear River water entering and leaving Idaho did not differ in terms of TSS or TP concentrations. Between 2006 and 2015, mean TSS was 42 mg/L as the Bear River entered Idaho and 37 mg/L as it left. Median TSS was 21 and 19 mg/L, respectively. Similarly, mean TP concentration was 0.081 mg/L as the Bear River entered Idaho and 0.072 mg/L when the Bear River entered Utah (median 0.051 and 0.048, respectively). On average, TP concentrations exceed TMDL targets, while TSS does not. Water quality entering and leaving Idaho also varied seasonally. For example, concentrations of TSS and TP tended to be higher in water entering Idaho during runoff. While TP and TSS were higher in water entering Utah during the summer.

In contrast to TSS and TP, nitrogen concentrations tend to increase in the Bear River as it travels through Idaho, reflecting land use and ground water inputs. Mean total nitrogen concentration was 73% higher at the Idaho-Utah border (0.85 mg/L) than at the Idaho-Wyoming border (0.49 mg/L).

Patterns in water quality reflected adjacent channel conditions. In reaches of the river with high percentages of unstable and uncovered banks, TSS concentrations tended to increase in the downstream direction. Patterns in water quality were also explained by flow manipulation for irrigation deliveries. For instance, TSS concentrations are high in summer below the Bear Lake Outlet Canal as water is pumped out of Bear Lake for irrigation deliveries downstream.

In 2015, sampling of tributaries to the Bear River was conducted as part of the 5-year review process. In the Central Bear subbasin (HUC 16010102), Thomas Fork and Sheep Creek enter the river. Thomas Fork did not exceed TMDL targets as it entered the Bear River during 2015 sampling. Below Sheep Creek Reservoir, Sheep Creek was mainly dry in 2015. Above the reservoir, water was turbid and likely exceeded TMDL targets as cattle have unrestricted access to the stream.

In the Bear Lake subbasin (HUC16010202), Ovid, Georgetown, Stauffer, Skinner, Pearl, Eightmile, Sulphur Canyon, Bailey, and Soda Creeks enter the river. In general, these tributaries met their TMDL targets in 2015, and water clarity tended to be high. Many of these streams are supporting beneficial uses in their upper reaches and should be placed in Category 2 in the next Integrated Report. In their lower reaches, however, these streams are diverted for agriculture and many do not reach the river during summer months.

P4's (a subsidiary of Monsanto) elemental phosphorus plant in Soda Springs discharges to Soda Creek. During a 2013 EPA inspection of the facility, TP was 0.885 mg/L in its discharge. P4 discharges approximately 4.68 cubic feet per second (cfs) to Soda Creek resulting in a load of 22.4 pounds (lb) TP/day. This load exceeds the entire load allocated for Soda Creek in the 2006 TMDL (12.6 lb/day TP). DEQ's sampling of lower Soda Creek above Alexander Reservoir has documented numerous exceedances of TP targets (0.050 mg/L) since 2008 (range = 0.058–0.43 mg/L, average = 0.25 mg/L). During periods when the stream was not diverted for irrigation, TP loads ranged from 18.1 to 62.6 lb/day. Future National Pollution Elimination Discharge System (NPDES) permits should limit phosphorus discharges to Soda Creek. The NPDES permit that P4 currently discharges under expired in 1987and was administratively extended. This permit only addresses the thermal load and does not limit phosphorus.

In the Middle Bear subbasin (HUC 16010202), Smith, Alder, Whiskey, Burton, Trout, Williams, Cottonwood, Mink, Battle, Deep, Fivemile, and Weston Creeks enter the river. The Cub River (Maple and Worm Creeks are tributaries) enters the Bear River in Utah but originates in and flows through Idaho. Above Oneida Reservoir, Whiskey, Trout, and Williams Creeks enter the river on its east side. These are spring-fed creeks and generally were meeting TMDL targets in 2015. One exceedance likely occurred in Trout Creek in August when turbidity was elevated due to cattle in the creek. In contrast, streams that enter the river on the west side, (Smith, Alder, and Burton Creeks) had poor water quality. Alder and Burton Creeks are intercepted by a ditch and run through areas that are heavily impacted by cattle operations. Alder Creek exceeded water quality standards for *E. coli* in 2015. Cottonwood Creek is the largest tributary to the Bear River in the Middle Bear subbasin in Idaho. It generally had good water quality, although it is completely dewatered before it enters Oneida Reservoir in the summer.

Below Oneida Reservoir, Battle, Deep, Fivemile, and Weston Creeks enter the Bear River on its west bank. These streams had poor water quality, and numerous exceedances of TMDL targets were observed in 2015. Fivemile Creek exceeded water quality standards for *E. coli*. Deep Creek contributed the highest sediment and phosphorus load to the river. Future restoration actions should focus of reducing sediment loads in these streams.

Maple Creek enters the Cub River then flows south into Utah before joining the Bear River. Maple Creek was the only stream in the basin to receive a TMDL for *E. coli*. Both Upper and Lower Maple Creek had clear and cold water, but flows were reduced at Lower Maple Creek. Upper Maple Creek met water quality standards for *E. coli* in 2015, while Lower Maple Creek exceeded the standard by over 10 times. This is likely due to livestock impacts in the area. The Cub River had good water quality, and no exceedances of TMDL targets were observed. Flows in the Cub River, however, are greatly reduced from natural levels as the river is heavily diverted for irrigation. Worm Creek had poor water quality, and exceedances of TMDL targets were documented in 2015. Cropland borders Worm Creek, and riparian buffers are absent along much of its length. Best management practices under the agricultural implementation plan have not yet been fully accomplished.

The Lower Bear/Malad subbasin (HUC 16010204) drains to the Malad River, which enters the Bear River in Utah. Tributaries to the Malad River include Devil Creek, Deep Creek, Wright Creek, and Little Malad River. Tributaries to Devil Creek that are under the 2006 TMDL include Campbell and Evans Creeks. Indian Mill Creek is a tributary to Wright Creek, and Wright Creek is a tributary to Daniels Reservoir. Most streams in the Malad subbasin exceeded TMDL targets in 2015. Complete dewatering of streams by summer was also common.

In the Malad subbasin, many AUs are on the §303(d) list for *E. coli*. Sampling in 2015 documented that Campbell Creek (ID16010204BR002_02a), Devil Creek (ID16010204BR002_02 and ID16010204BR002_03), and Upper (ID16010204BR010_02b), Middle (ID16010204BR010_03), and Lower Wright (ID16010204BR010_04) Creeks exceeded water quality standards for *E. coli*. The Little Malad River (ID16010204BR008_04) met water quality standards for *E. coli* in 2015.

Beneficial Use Reconnaissance Program (BURP) data have been collected on AUs included in the Bear River basin since 1993, and data collection will continue into the future. BURP data identified several AUs that are under the 2006 TMDL but are fully supporting cold water aquatic life. Seven of these AUs are contained in the upper reaches of the Bear Lake subbasin. While aquatic habitat is degraded below these upper AUs, BURP data indicate that cold water aquatic life is fully supported in Upper Bailey Creek (ID1601201BR003_02a), Upper Eightmile Creek (ID16010201BR004_02), North and South Forks Stauffer Creek (ID16010201BR006_02c), Upper Stauffer Creek (ID16010201BR006_02d), North and South Forks Skinner Creek (ID16010201BR007_02a), and Upper Georgetown Creek (ID16010201BR022_02b).

Additionally, 2015 water quality sampling confirms that TMDL targets are being achieved. These AUs should be placed in Category 2 in the next Integrated Report.

In the Middle Bear subbasin, Upper Maple Creek (ID16010202BR003_02a) received a TMDL for *E. coli* in the 2006 TMDL (DEQ 2006a). BURP data indicate that this stream segment is fully supporting beneficial uses, and 2015 *E. coli* data indicate that water quality standards are being achieved. This AU should be placed in Category 2 in the next Integrated Report. A tributary to Mink Creek, Birch Creek (ID16010202BR007_02) is under the 2006 TMDL for TSS and TP. BURP data indicate that this AU is fully supporting cold water aquatic life, and 2015 sampling documented that TMDL targets are being achieved. This AU should be placed in Category 2 in the next Integrated Report.

In the Lower Bear/Malad subbasin, Indian Mill Creek (ID16010204BR010_02a) is under the 2006 TMDL for TSS and TP. BURP data indicate that cold water aquatic life is fully supported, and 2015 sampling indicates that TSS and TP targets are being achieved. This AU should be placed in Category 2 in the next Integrated Report. Recommended changes to the next Integrated Report are summarized in Table C.

Table C. Summary of recommended changes for AUs evaluated.

Stream Name	Assessment Unit Number	Pollutant	Recommended Changes to Next Integrated Report	Justification
Upper Bailey Creek	ID16010201BR003_02a	TP and TSS	Move from Category 4a to Category 2.	BURP scores indicate full support of CWAL. 2015 water quality sampling indicates that TMDL targets are being achieved.
Upper Eightmile Creek	ID16010201BR004_02	TP and TSS	Move from Category 4a to Category 2.	BURP scores indicate full support of CWAL. 2015 water quality sampling indicates that TMDL targets are being achieved.
North and South Forks Stauffer Creek	ID16010201BR006_02c	TP and TSS	Move from Category 4a to Category 2.	BURP scores indicate full support of CWAL. 2015 water quality sampling indicates that TMDL targets are being achieved.
Stauffer Creek	ID16010201BR006_02d	TP, TSS, and *E. coli*	Keep listed in Category 5 for *E. coli* and move CWAL to Category 2.	BURP scores indicate full support of CWAL. 2015 water quality sampling indicates that TP and TSS TMDL targets are being achieved.
North and South Forks Skinner Creek	ID16010201BR007_02a	TP and TSS	Move from Category 4a to Category 2.	BURP scores indicate full support of CWAL. 2015 water quality sampling indicates that TMDL targets are being achieved.
Upper Georgetown Creek	ID16010201BR022_02b	TP, TSS, and selenium	Keep listed in Category 5 for selenium and move from Category 4a to Category 2 for TP and TSS.	BURP scores indicate full support of CWAL. 2015 water quality sampling indicates that TMDL targets are being achieved.
Upper Maple Creek	ID16010202BR003_02a	*E. coli*	Move from Category 4a to Category 2.	2015 *E. coli* geometric mean = 6 cfu/100 mL. TMDL targets are being achieved and recreational beneficial use is fully supported.
Birch Creek	ID16010202BR007_02	Combined biota/habitat bioassessments, TP, and TSS	Move from Category 4a to Category 2 for CWAL and delist from Category 5 for combined biota/habitat bioassessments.	BURP scores indicate full support of CWAL. 2015 water quality sampling indicates that TMDL targets are being achieved.
Indian Mill Creek	ID16010204BR010_02a	TP and TSS	Move from Category 4a to Category 2.	BURP scores indicate full support of CWAL. 2015 water quality sampling indicates that TMDL targets are being achieved.

Notes: total phosphorus (TP), total nitrogen (TN), *Escherichia coli (E. coli);* Beneficial Use Reconnaissance Program *(*BURP); cold water aquatic life (CWAL); colony forming unit (cfu); milliliter (mL)

1 Introduction

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters (33 USC §1251). States and tribes, pursuant to Section 303 of the CWA, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. CWA §303(d) establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards.

Idaho Code §39-3611(7) requires a 5-year cyclic review process for Idaho TMDLs:

> The director shall review and reevaluate each TMDL, supporting subbasin assessment, implementation plan(s) and all available data periodically at intervals of no greater than five (5) years. Such reviews shall include the assessments required by section 39-3607, Idaho Code, and an evaluation of the water quality criteria, instream targets, pollutant allocations, assumptions and analyses upon which the TMDL and subbasin assessment were based. If the members of the watershed advisory group, with the concurrence of the basin advisory group, advise the director that the water quality standards, the subbasin assessment, or the implementation plan(s) are not attainable or are inappropriate based upon supporting data, the director shall initiate the process or processes to determine whether to make recommended modifications. The director shall report to the legislature annually the results of such reviews.

To meet the intent and purpose of Idaho Code §39-3611(7), this report documents reviews of the *Bear River/Malad River Subbasin Assessment and Total Maximum Daily Load Plan* (DEQ 2006a) and addresses water bodies in the Bear River subbasin that are in Idaho's most recent Category 4a of the Integrated Report (DEQ 2014a). This report reviews the approved TMDL (DEQ 2006a) and implementation plans and considers the most current and applicable information in conformance with Idaho Code §39-3607, evaluates the appropriateness of the TMDL to current watershed conditions, evaluates the implementation plan, and consults with the watershed advisory group. An evaluation of the recommendations presented is provided. Final decisions for TMDL modifications are decided by the Idaho Department of Environmental Quality (DEQ) director. Approval of TMDL modifications is decided by the United States Environmental Protection Agency (EPA), with consultation by DEQ.

1.1 Assessment Units

Assessment units (AUs) are groups of similar streams that have similar land use practices, ownership, or land management. Stream order is the main basis for determining AUs—even if ownership and land use change significantly, the AU usually remains the same for the same stream order.

Using AUs to describe water bodies offers many benefits primarily that all waters of the state are defined consistently. AUs are a subset of water body identification numbers, which allows them to relate directly to the water quality standards.

2 TMDL Review and Status

The Bear River/Malad River subbasins in southeastern Idaho (Figure 1) are tributary watersheds of the Great Salt Lake in northern Utah. These watersheds encompass an area of 2,800 square miles in Idaho.

The Bear River/Malad River TMDL was completed in 2006 and approved by EPA. In the Central Bear subbasin hydrologic unit code (HUC) (16010102), TMDLs were developed for four AUs including the main stem Bear River, Thomas Fork, and two AUs of Sheep Creek (Figure 2). In the Bear Lake HUC (16010201), TMDLs were developed on 25 AUs including sections of the main stem Bear River, Sulphur Canyon, and Bailey, Eightmile, Pearl, Stauffer, Skinner, Ovid, Georgetown, and Soda Creeks (Figure 3). In the Middle Bear HUC (16010202), TMDLs were developed for 37 AUs including portions of the main stem Bear and Cub Rivers, and Worm, Deep, Mink, Smith, Alder, Burton, Williams, Trout, Whiskey, Densmore, Cottonwood, Battle, Fivemile, and Weston Creeks (Figure 4). Finally, in the Lower Bear/Malad River HUC (16010204), TMDLs were completed for 20 AUs including portions of the Malad and Little Malad Rivers and Devil, Campbell, Evans, Deep, Elkhorn, and Wright Creeks (Figure 5). Table 1 provides the TMDLs and associated sources of pollution for the Bear River basin. A complete list of the Bear River/Malad River subbasin assessments, TMDLs, and implementation plans can be accessed at *http://www.deq.idaho.gov/bear-river-basin-malad-river-subbasin*.

Subbasin: Bear River/ Malad River

HUCs:
Central Bear: 16010102
Bear Lake: 16010201
Middle Bear: 16010202
Lower Bear / Malad: 16010204

Beneficial Uses: Cold water aquatic life, salmonid spawning, primary/secondary contact recreation, domestic water supply, agricultural water supply

Uses Affected: Cold water aquatic life, salmonid spawning, primary/secondary contact recreation

Pollutants: Sediment, bacteria, nutrients, dissolved oxygen, temperature

Sources:
Point sources: Waste water treatment plants, fish farms and hatcheries
Nonpoint sources: Agriculture, grazing, mining, recreation, roads

Figure 1. Location and characteristics of the Bear River/Malad River subbasin.

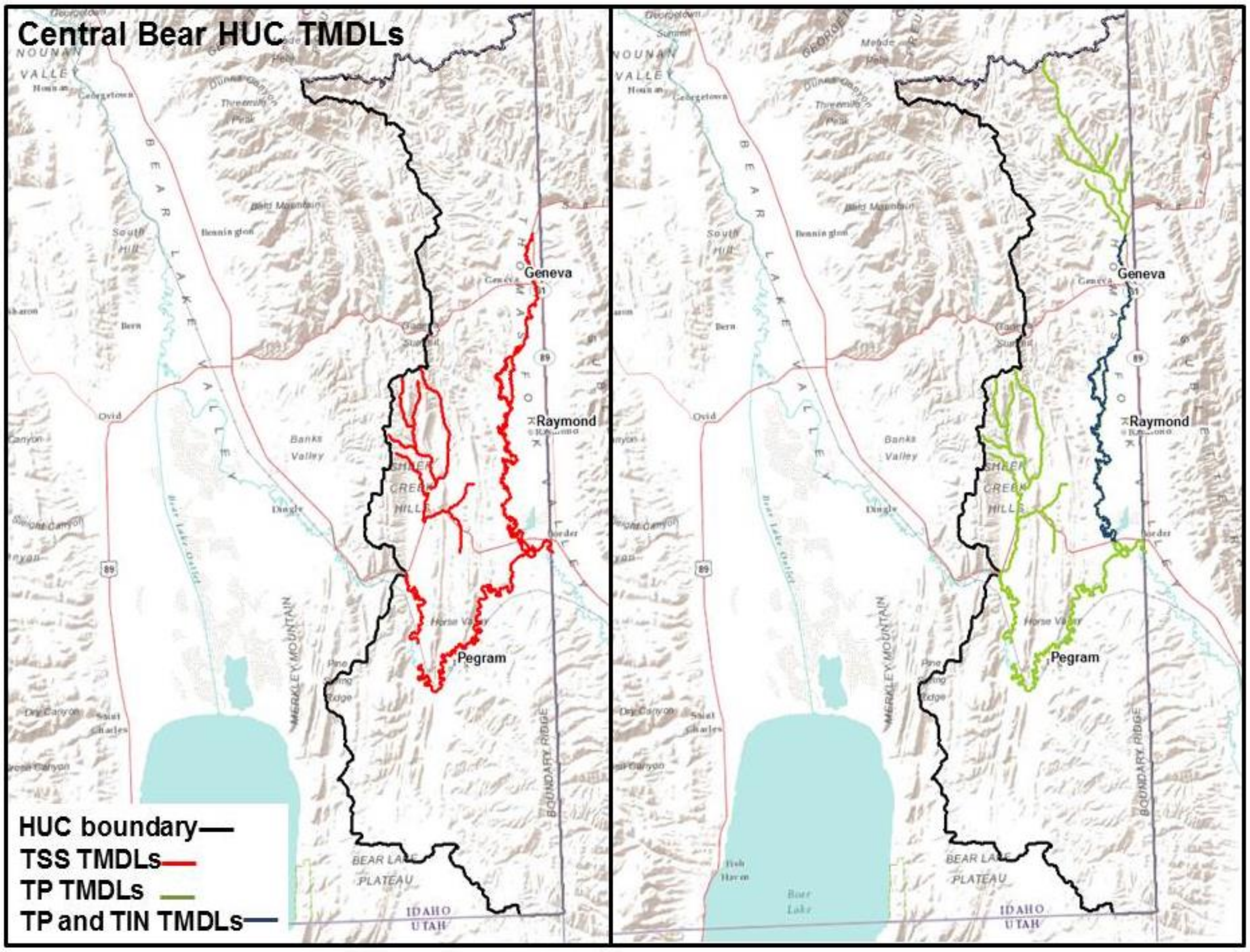


Figure 2. Water bodies with 2006 TMDLs in the Central Bear HUC (16010102).

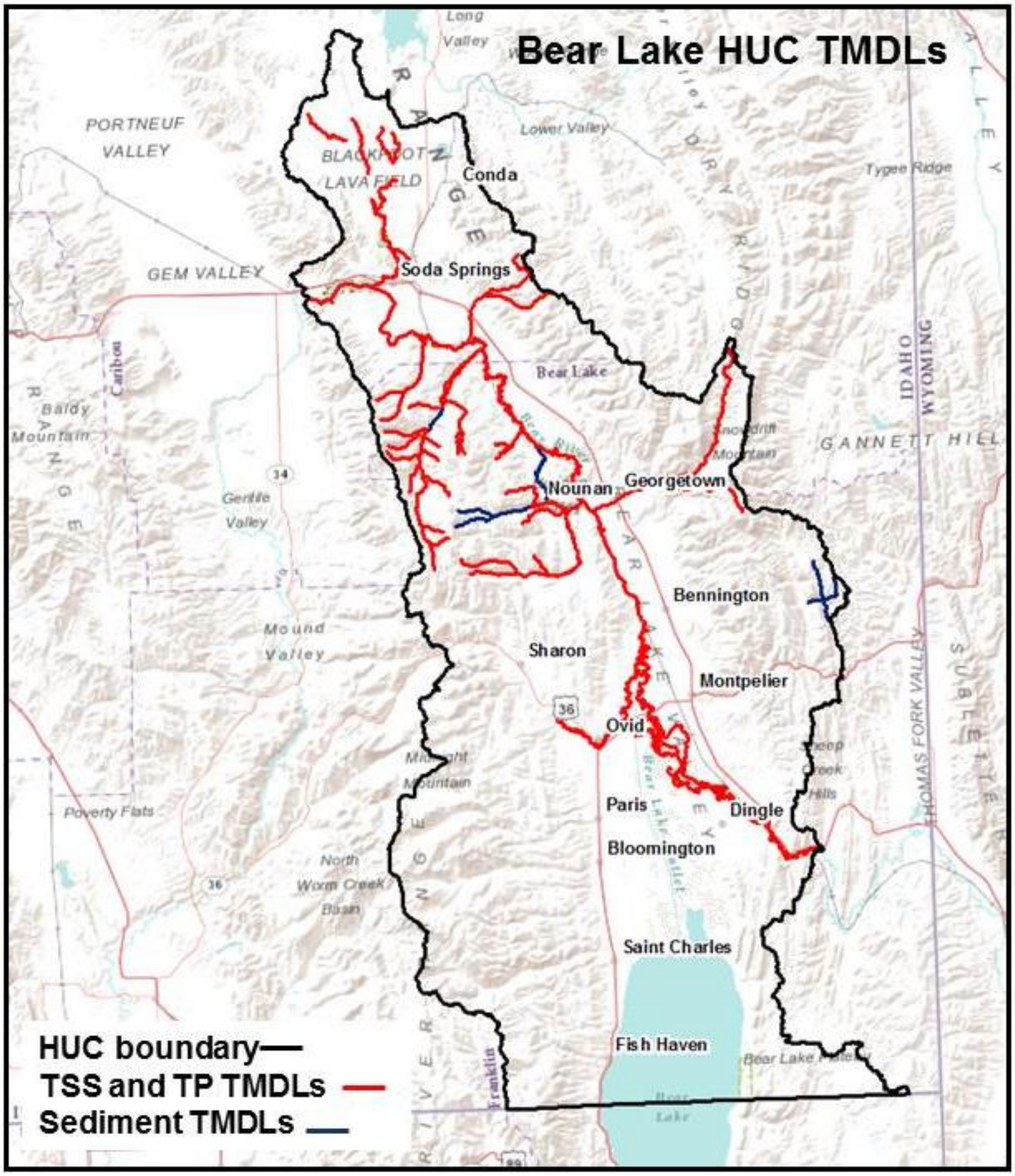


Figure 3. Water bodies with 2006 TMDLs in the Bear Lake HUC (16010201).

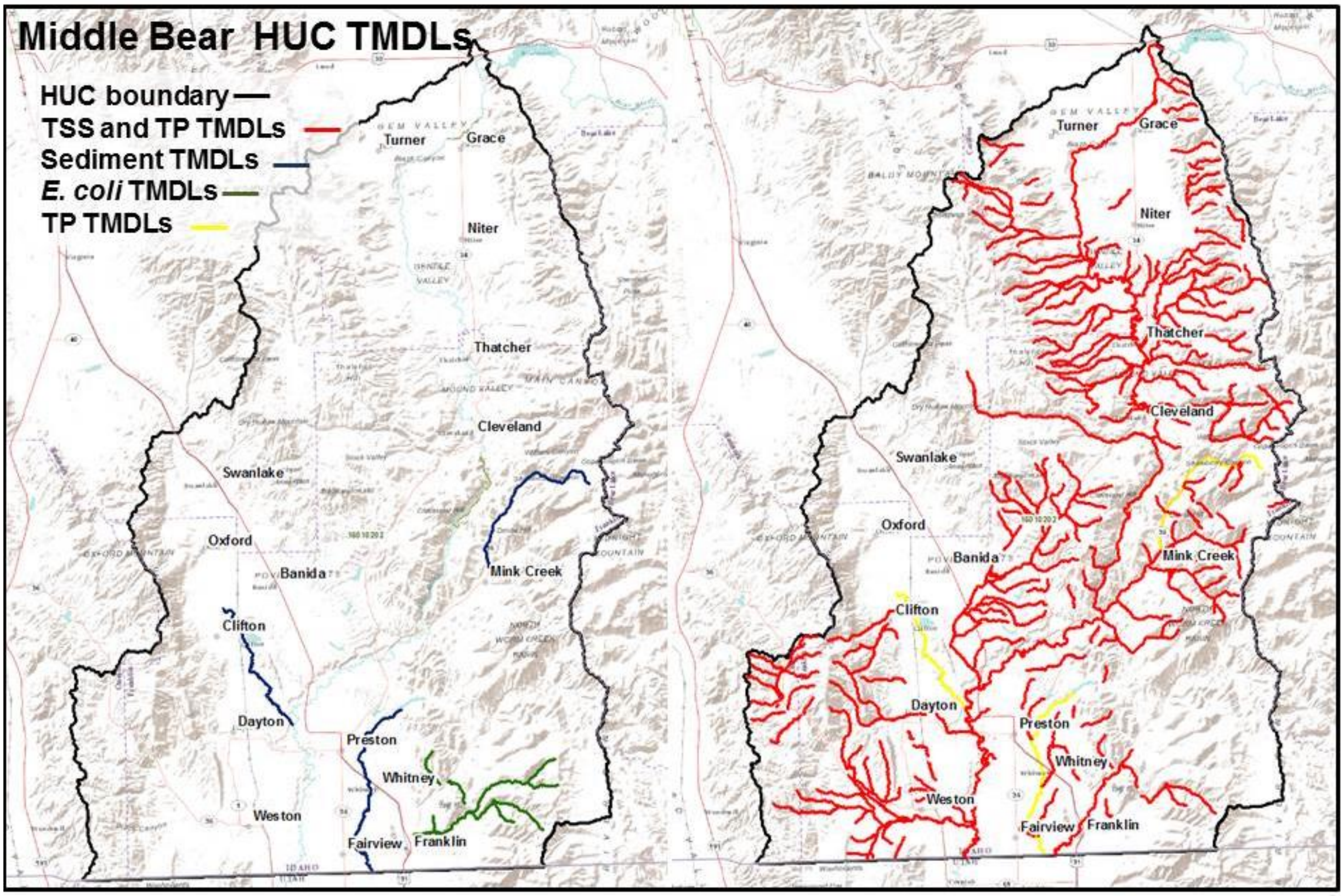


Figure 4. Water bodies with 2006 TMDLs in the Middle Bear HUC (16010202).

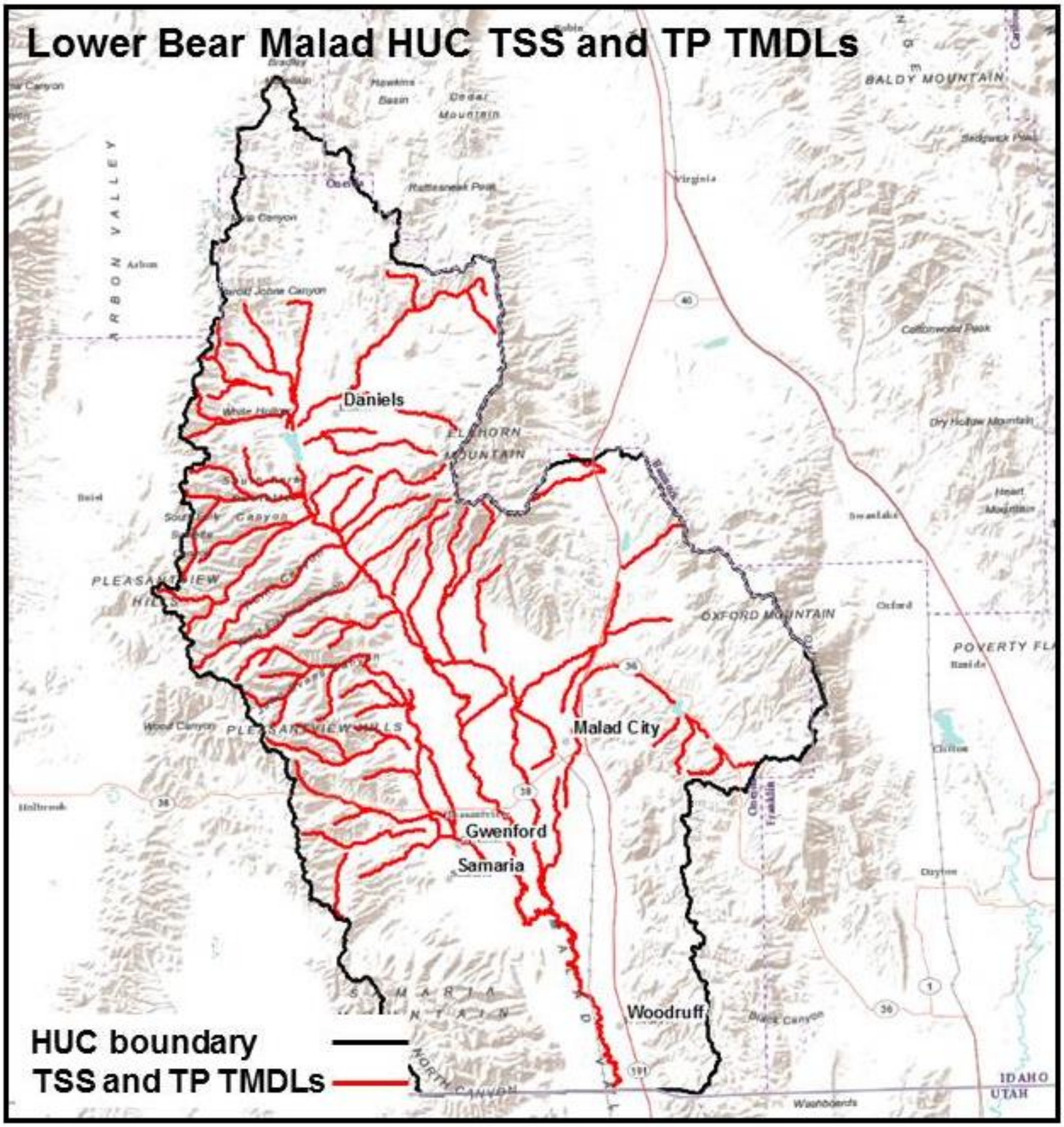


Figure 5. Water bodies with 2006 TMDLs in the Lower Bear Malad HUC (16010204).

Table 1. Applicable TMDLs for the Bear River basin and associated sources of pollution.

Assessment Unit Name	Assessment Unit Number	Pollutant	Pollutant sources
Bear River—Idaho-Wyoming border to railroad bridge	ID16010102BR001_05	TP, TSS	Agriculture, livestock grazing, instream channel, and eroding streambanks
Thomas Fork—Idaho-Wyoming border to mouth	ID16010102BR003_04	TN, TP, TSS	Agriculture, livestock grazing, instream channel, and eroding streambanks
Sheep Creek		TP, sedimentation	Livestock grazing
- Source to mouth	ID16010102BR008_02		
- Source to mouth	ID16010102BR008_03		
Alexander Reservoir	ID16010201BR001_0L	TP, TSS	Agriculture, livestock grazing, instream channel, and eroding streambanks
Sulphur Canyon—Headwaters (Middle and South Forks Sulphur Creek) to mouth	ID16010102BR002_02a	TP, TSS	Agriculture, livestock grazing, instream channel, and eroding streambanks
Lower Skinner Creek—Above Nounan Road crossing to Bear River	ID16010201BR002_02c	TP, sedimentation	Agriculture, livestock grazing, instream channel, and eroding streambanks
Bear River—Railroad bridge (T14N, R45E, Sec. 21) to Ovid Creek	ID16010201BR002_05	TP, TSS	Agriculture, livestock grazing, instream channel, and eroding streambanks
Bear River—Ovid Creek confluence to Alexander Reservoir	ID16010201BR002_06	TP, TSS	Montpelier WWTP, Soda Springs WWTP, agriculture, livestock grazing, instream channel, and eroding streambanks
Bailey Creek			Agriculture, livestock grazing, instream channel, and eroding streambanks
- Lower: Forest Service boundary to mouth	ID16010201BR003_02	TP, TSS	
- Upper: headwaters to Forest Service boundary	ID16010201BR003_02a		
Eightmile Creek			
- Headwaters to North Fork Wilson Creek	ID16010201BR004_02	TP, TSS	Agriculture, livestock grazing, instream channel, and eroding streambanks
- South Wilson Creek	ID16010201BR004_02a		
- 1 mile below Forest Service boundary to mouth	ID16010201BR004_03		
- North Fork Wilson Creek to 1 mile below Forest Service boundary	ID16010201BR004_03a		
Pearl Creek			Agriculture, livestock grazing, instream channel, and eroding streambanks
- Lower	ID16010201BR005_02	TP, TSS	
- Middle	ID16010201BR005_02a		

Assessment Unit Name	Assessment Unit Number	Pollutant	Pollutant sources
Stauffer Creek			Agriculture, livestock grazing
- North and South Forks Stauffer Creek and Stauffer Creek to Beaver Creek	ID16010201BR006_02c	TP, TSS	
- Beaver Creek to Spring Creek	ID16010201BR006_02d		
- Lower: Spring Creek to Bear River	ID16010201BR006_03		
North and South Forks Skinner Creek	ID16010201BR007_02a	TP, TSS	
Ovid Creek—Confluence of north fork and Mill Creek to mouth	ID16010201BR009_04	TP, TSS	Agriculture, livestock grazing
Georgetown Creek			Agriculture, livestock grazing, historic mining activities
- Right-hand fork	ID16010201BR022_02a	TP, TSS	
- Upper: headwaters to left-hand fork	ID16010201BR022_02b		
- Lower: left-hand fork to mouth	ID16010201BR022_03a		
Soda Creek		TP, TSS	Agriculture, livestock grazing. P4 production
- Soda Creek Reservoir to Soda Springs	ID16010201BR023_02a		
- Lower: Soda Springs to Alexander Reservoir	ID16010201BR023_02b		
- Soda Creek Reservoir	ID16010201BR024_02		
- Source to Soda Creek Reservoir	ID16010201BR025_02		
Cub River		TP, TSS, *E. coli*	Franklin WWTP, agriculture, livestock grazing, instream channel, and streambank erosion
- Maple Creek to border	ID16010202BR002_04		
- Sugar Creek to US Highway 91 bridge	ID16010202BR003_02		
- Maple Creek: Left Fork Maple Creek to Cub River	ID16010202BR003_02a		
- Sugar Creek to Maple Creek	ID16010202BR003_03		
- Maple Creek	ID16010202BR003_03a		
Worm Creek		TP, TSS, sedimentation	Preston WWTP, agriculture, livestock grazing, instream channel, and streambank erosion
- Unnamed tributaries	ID16010202BR005_02		
- Lower: Glendale Reservoir to border	ID16010202BR005_02b		
Bear River—Oneida Narrows Reservoir to Idaho-Utah border	ID16010202BR006_02	TP, TSS	
Deep Creek	ID16010202BR006_02a	TP, sedimentation	Agriculture, livestock grazing, instream channel, and streambank erosion
Bear River—Oneida Narrows Reservoir to Idaho-Utah border	ID16010202BR006_06	TP, TSS	Agriculture, livestock grazing, instream channel, and streambank erosion

Assessment Unit Name	Assessment Unit Number	Pollutant	Pollutant sources
Mink Creek			Agriculture, livestock grazing, instream channel, and streambank erosion
- Mink and Strawberry Creek: 2nd-order tributaries	ID16010202BR007_02	TP, TSS	
- Source to mouth	ID16010202BR007_03		
Oneida Narrows Reservoir	ID16010202BR008_0L	TP, TSS	Agriculture, livestock grazing, instream channel, and streambank erosion
Unnamed tributaries	ID16010202BR009_02	TP, TSS	Agriculture, livestock grazing, instream channel, and streambank erosion
Smith Creek—Headwaters to mouth	ID16010202BR009_02a	TP, TSS	Agriculture, livestock grazing, fish hatchery
Alder Creek—Headwaters to mouth	ID16010202BR009_02b	TP, TSS	Agriculture, livestock grazing
Burton Creek—Headwaters to mouth	ID16010202BR009_02c	TP, TSS	Agriculture, livestock grazing
Bear River			Grace WWTP, agriculture, livestock grazing
- Alexander Reservoir to Denismore Creek	ID16010202BR009_06	TP, TSS	
- Denismore Creek to above Oneida Reservoir	ID16010202BR009_06		
Williams Creek			Agriculture, livestock grazing, instream channel, and streambank erosion
- Source to mouth	ID16010202BR010_02	TP, TSS	
- Forest Service boundary to Bear River	ID16010202BR010_02a		
Trout Creek			Agriculture, livestock grazing, instream channel, and streambank erosion
- Source to mouth	ID16010202BR011_02	TP, TSS	
- Source to mouth	ID16010202BR011_03		
Whiskey Creek—Source to mouth	ID16010202BR012_02	TP, TSS	Grace Fish Hatchery, agriculture, livestock grazing, instream channel, and streambank erosion
Densmore Creek—Source to mouth	ID16010202BR013_02	TP, TSS	Agriculture, livestock grazing, instream, channel, and streambank erosion
Cottonwood Creek—Lower Cottonwood Creek (4th order)	ID16010202BR014_04	TP, TSS	Agriculture, livestock grazing, instream channel, and streambank erosion
Battle Creek		TP, TSS	Agriculture, livestock grazing, instream channel, and streambank erosion
- Upper Battle Creek and unnamed tributaries	ID16010202BR015_02		
- Source to mouth	ID16010202BR015_03		
- Source to mouth	ID16010202BR015_04		

Assessment Unit Name	Assessment Unit Number	Pollutant	Pollutant sources
Fivemile Creek		TP, TSS	Agriculture, livestock grazing, instream channel, and streambank erosion
- Source to Dayton	ID16010202BR019_02		
- Dayton to mouth	ID16010202BR019_02a		
Weston Creek			Agriculture, livestock grazing, instream channel, and streambank erosion
- Unnamed tributaries	ID16010202BR020_02	TP, TSS	
- Black Canyon	ID16010202BR020_02a		
- Upper Weston Creek: Forest Service boundary to reservoir	ID16010202BR020_02c		
- Headwaters to Forest Service boundary and Trail Hollow	ID16010202BR020_02d		
- Dry Canyon to above Weston City	ID16010202BR020_03		
- Above Weston City to Bear River	ID16010202BR020_04		
Malad River—Little Malad River to Idaho-Utah border	ID16010204BR001_04	TP, TSS	Agriculture, livestock grazing, instream channel, and streambank erosion
Devil Creek—Devil Creek Reservoir Dam to mouth	ID16010204BR002_02	TP, TSS	Agriculture, livestock grazing, instream channel, and streambank erosion
Campbell Creek	ID16010204BR002_02a	TP, TSS	Agriculture, livestock grazing, instream channel, and streambank erosion
Evans Creek	ID16010204BR002_02c	TP, TSS	Agriculture, livestock grazing, instream channel, and streambank erosion
Devil Creek—Devil Creek Reservoir to mouth	ID16010204BR002_03	TP, TSS	Agriculture, livestock grazing, instream channel, and streambank erosion
Deep Creek—Deep Creek Reservoir to mouth	ID16010204BR005_03	TP, TSS	Agriculture, livestock grazing, instream channel ,and streambank erosion
Susan Hollow	ID16010204BR006_02	TP, TSS	Agriculture, livestock grazing, instream channel, and streambank erosion
Deep Creek			Agriculture, livestock grazing, urban activities, instream channel, and streambank erosion
- Deep Creek Reservoir	ID16010204BR006_03	TP, TSS	
- Source to upper Deep Creek Reservoir	ID16010204BR007_02		
- Upper Deep Creek Reservoir to Deep Creek Reservoir	ID16010204BR007_03		
Malad River—Mouth and unnamed tributaries to North Fork Canyon	ID16010204BR008_02	TP, TSS	Agriculture, livestock grazing, instream channel, and streambank erosion

Assessment Unit Name	Assessment Unit Number	Pollutant	Pollutant sources
Elkhorn Creek—Source to mouth	ID16010204BR008_02a	TP, TSS	Agriculture, livestock grazing, instream channel, and streambank erosion
Little Malad River			Agriculture, livestock grazing, instream channel, and streambank erosion
- Daniels Reservoir Dam to mouth	ID16010204BR008_03	TP, TSS	
- Daniels Reservoir Dam to mouth	ID16010204BR008_04		
Little Malad River—Headwaters to Daniels Reservoir	ID16010204BR009_02	TP, TSS	Agriculture, livestock grazing, instream channel, and streambank erosion
Wright Creek			Perlite mining, road maintenance practices, agriculture, livestock grazing, instream channel, and streambank erosion
- Indian Mill Creek	ID16010204BR010_02a	TP, TSS	
- Upper Wright Creek: headwaters to Indian Mill Canyon	ID16010204BR010_02b		
- Middle Wright Creek: Indian Mill Canyon to Dairy Creek	ID16010204BR010_03		
- Dairy Creek to Daniels Reservoir	ID16010204BR010_04		
Malad River—Source to Little Malad River	ID16010204BR012_02	TP, TSS	Agriculture, livestock grazing, instream channel, and streambank erosion

Notes: TP = total phosphorus, TSS = total suspended solids.

In the 2006 TMDL, targets for sediment, nutrients, and bacteria were developed for water bodies impaired by these pollutants. Since phosphorus was the excess nutrient in most water bodies impaired by nutrient pollution, total phosphorus (TP) targets were developed. For water bodies that flow into other streams or rivers, the TP target was 0.075 milligrams per liter (mg/L). For water bodies that flow into a lake or reservoir, the TP target was set at 0.05 mg/L. Since nitrogen was determined to also be in excess in Thomas Fork (ID16010102BR003_04), a total nitrogen (TN) target was established at 0.85 mg/L. Targets for total suspended solids (TSS) were stratified into runoff and base flow conditions. During runoff, TSS was not to exceed 80 mg/L for streams flowing into other streams and 60 mg/L for streams flowing into a lake or reservoir. During base flow, TSS was not to exceed 60 mg/L for streams flowing into other streams and 35 mg/L for streams flowing into a lake or reservoir. *Escherichia coli (E. coli*) bacteria limits were set at the water quality criteria of a 5-sample geometric mean of 126 colony forming units (cfu)/100 milliliter (mL) of water.

Point sources in the subbasin included wastewater treatment plants (WWTPs) for the cities of Montpelier, Soda Springs, Grace, Preston, and Franklin. Each WWTP received load allocations for TP and TSS. TP load reductions were required for each of these WWTPs as part of the original 2006 TMDL. However, the 2013 addendum reviewed these waste loads relative to extensive monitoring data collected on the mainstem Bear River (2006–2009). As phosphorus targets were met in the river (except excess TP associated with sediment during high flows), waste load allocations were revised to dischargers' (Montpelier, Soda Springs, and Grace) current loads. The city of Franklin was permitted their present load during the nongrowing season with a waste load allocation based on 0.050 mg/L TP during the growing season (May through September). Preston's discharge was reevaluated with regard to Worm Creek phosphorus concentrations. A waste load reduction based on a 0.075 mg/L TP discharge concentration was required in the addendum. The WWTP in Georgetown discharged to an unnamed tributary of the Bear River, and a target TP concentration was set at 0.075 mg/L. Georgetown chose to convert to land application of their wastewater.

TP and TSS load allocations were also developed for Clear Springs Food, Grace Fish Hatchery, and Bear River Trout Farm. Reductions in TP or TSS were not required from these point sources. Nonpoint sources of pollution in the subbasin include agriculture, livestock grazing, road and culvert maintenance, urban activities, and excessive in-channel and streambank erosion.

2.1 Pollutant Targets

Idaho's "Water Quality Standards" (IDAPA 58.01.02) for sediment and nutrients are narrative; no specific quantitative value is established for sediment and nutrients in Idaho code. Numeric targets for the TMDL were set using a collection of literature sources that provided information relating numeric values to the attainment of beneficial uses. Table 2 outlines numeric targets set for this TMDL and the streams for which they apply.

Table 2. Pollutant targets established for the Bear River basin.

Water Body	Pollutant	Parameter	Numeric Target
All streams	Nutrients	Total phosphorus	0.075 mg/L for streams draining into another stream 0.05 mg/L for streams draining into a lake or reservoir
All streams	Sediment	Total suspended solids	During runoff • 80 mg/L for streams draining into another stream • 60 mg/L for streams draining into a lake or reservoir During base flow • 60 mg/L for streams draining into another stream • 35 mg/L for streams draining into a lake or reservoir
All streams	Bacteria	*E. coli*	5-sample geometric mean collected within 3 to 7 days of each other <126 cfu/100 mL
Thomas Fork (ID16010102BR003_04)	Nutrients	Total nitrogen	0.85 mg/L

Notes: milligram per liter (mg/L), colony forming units (cfu); *Escherichia coli* (*E. coli*); milliliter (mL)

2.1.1 Sediment

Sediment targets for the Bear River and all impaired tributaries are based on TSS concentrations. During runoff conditions, TSS is not to exceed 80 mg/L for water bodies draining into streams or rivers or 60 mg/L for streams draining directly into a lake or reservoir. During winter and summer base flow, TSS is not to exceed 60 mg/L in water bodies that drain into other streams or rivers or 35 mg/L for water bodies that drain directly into a lake or reservoir. Excess sediment loads are calculated by multiplying TSS concentration above the target by measured streamflow.

2.1.2 Nutrients

Nutrient targets were mainly for phosphorus because it was determined to be the nutrient in excess in the majority of impaired water bodies in the Bear River basin. TP is not to exceed 0.075 mg/L for water bodies draining into a stream or river or 0.05 mg/L for water bodies draining into a lake or reservoir. In the Thomas Fork (ID16010102BR003_04), nitrogen was determined to be also in excess. In this AU, TN is not to exceed 0.85 mg/L.

2.2 Control and Monitoring Points

The Bear River basin TMDL (DEQ 2006a) did not specifically address monitoring objectives for impaired streams. For this 5-year review, all data collected on AUs will serve as a monitoring point for the TMDL. Beneficial Use Reconnaissance Program (BURP) data will be used to assess beneficial use support status since development of the original TMDL in 2006. Data collected by DEQ on water chemistry (TP, TSS, and TN) and discharge will be used to evaluate the trends in these variables related to time and implementing restoration efforts and best management practices (BMPs).

The objectives of these monitoring efforts are to evaluate long-term recovery, better understand natural variability, track implementation of projects and BMPs once they are developed, and oversee the effectiveness of TMDL implementation. This monitoring and feedback mechanism is a major component of the *reasonable assurance of implementation* for the TMDL implementation plan. To the extent possible, DEQ and designated management agencies will collaborate to define data quality objectives that will guide monitoring through continued implementation of the Bear River TMDL. Some of these watershed objectives include the following:

- Evaluate watershed pollutant sources.
- Refine baseline conditions and pollutant load.
- Evaluate trends in water quality data.
- Evaluate the collective effectiveness of implementation actions in reducing sediment, temperature, and nutrient loads to water bodies.
- Gather information and fill data gaps to accurately determine pollutant loads.

The site-specific control/monitoring points outlined in the Bear River TMDL are described in DEQ (2006a), Table 2-24.

2.2.1 Nutrients

Water column nutrients should be monitored at previously established monitoring sites, in addition to downstream sites to reflect the downstream end of the nutrient TMDL segment. Continued sampling at established monitoring sites maintains consistency. Nutrient samples should be collected according to methodologies that yield the most accurate representation of water column nutrient levels.

2.3 Load Capacity

The load capacity estimates the quantity of pollutant a water body is believed to be able to receive and still maintain support of beneficial uses and meet water quality standards. The load capacity is estimated by combining flow and pollutant concentration data. If the target load was less than the existing load, the existing load became the assumed load capacity or allocation, so it was not implied that pollution could increase to the target concentration times the flow. Load capacities for specific pollutants are listed below, and load capacities for individual water bodies are listed in Table 3.

2.3.1 Sediment

The load capacity for sediment was based on TSS concentrations. During runoff, TSS is not to exceed 80 mg/L for water bodies draining into other streams or rivers or 60 mg/L for streams draining into a lake or reservoir. During winter and summer base flow conditions, TSS is not to exceed 60 mg/L for water bodies draining into other streams or rivers or 35 mg/L for streams draining into a lake or reservoir. If TSS loads in 1999–2000 were a result of TSS concentrations below these thresholds, load capacities were set at the current estimated load rates. In these cases, TSS loads were not to increase in the future.

2.3.2 Nutrients

The load capacity for nutrients was based on TP concentrations. TP was not to exceed 0.075 mg/L for waters entering other streams or rivers or 0.050 mg/L for waters entering lakes or reservoirs. Total inorganic nitrogen (TIN) targets were developed for Thomas Fork (ID16010102BR003_04) in Central Bear (HUC 16010102). TIN was not to exceed 0.85 mg/L. No other AUs received nitrogen targets.

2.4 Load Allocations

In the Bear River subbasin, sediment and nutrient load allocations were developed as shown in Table 3. When the target load was greater than the existing load, the existing load became the load allocation to not allow for further pollution in the already impaired water body. If the target load was less than the existing load, the load allocation became the target load, and a percent reduction was computed.

Table 3. Estimated sediment and total phosphorus loads (1999–2000) and load allocations for tributaries in the Bear River subbasin. AUs are arranged from upstream to downstream.

Assessment Unit Name	Assessment Unit Number	Existing Load	Target Load	Load Allocation	% Reduction to Meet Load Allocation	Existing Load	Target Load	Load Allocation	% Reduction to Meet Load Allocation
		kilograms per year total phosphorus				kilograms per year total suspended solids			
Thomas Fork	ID16010102BR003_04	4,018	3,879	3,879	3	2,668,996	3,536,201	2,668,996	0
Sheep Creek	ID16010102BR008_02 ID16010102BR008_02	27	115	27	0	7,807	104,585	7,807	0
Ovid Creek	ID16010201BR009_04	631	796	631	0	104,468	725,914	104,468	0
Georgetown Creek	ID16010201BR022_02a ID16010201BR022_02b ID16010201BR022_03a	1,722	1,562	1,562	9	376,986	1,423,842	376,986	0
Stauffer Creek	ID16010201BR006_02c ID16010201BR006_02d ID16010201BR006_03	709	1,019	709	0	218,122	928,778	218,122	0
Skinner Creek	ID16010102BR002_02a ID16010201BR007_02a	281	281	281	0	74,487	226,573	74,487	0
Pearl Creek	ID16010201BR005_02 ID16010201BR005_02a	227	530	227	0	86,061	483,576	86,061	0
Eightmile Creek	ID16010201BR004_02 ID16010201BR004_02a ID16010201BR004_03 ID16010201BR004_03a	482	1,306	482	0	230,891	1,190,792	230,891	0
Sulphur Canyon Creek	ID16010102BR002_02a	8	40	8	0	2,551	36,418	2,551	0
Bailey Creek	ID16010201BR003_02 ID16010201BR003_02a	197	357	197	0	96,307	325,806	96,307	0
Soda Creek	ID16010201BR023_02a ID16010201BR023_02b ID16010201BR024_02 ID16010201BR025_02	5,130	2,085	3,045	59	250,662	1,895,946	250,662	0

Assessment Unit Name	Assessment Unit Number	Existing Load	Target Load	Load Allocation	% Reduction to Meet Load Allocation	Existing Load	Target Load	Load Allocation	% Reduction to Meet Load Allocation
		kilograms per year total phosphorus				kilograms per year total suspended solids			
Densmore Creek	ID16010202BR013_02	406	141	141	65	85,198	128,538	85,198	0
Smith Creek	ID16010202BR009_02a	401	401	401	0	209,382	298,309	209,382	0
Alder Creek	ID16010202BR009_02b	622	622	622	0	81,662	372,464	372,464	0
Whiskey Creek	ID16010202BR012_02	852	848	848	0.5	134,419	773,330	134,419	0
Burton Creek	ID16010202BR009_02c	380	380	380	0	289,756	289,756	289,756	0
Trout Creek	ID16010202BR011_02 ID16010202BR011_03	1,187	1,112	1,112	6	586,581	1,014,079	586,581	0
Williams Creek	ID16010202BR010_02 ID16010202BR010_02a	334	1,458	334	0	95,413	1,329,131	95,413	0
Cottonwood Creek	ID16010202BR014_04	1,028	2,321	1,028	0	479,447	2,110,743	479,447	0
Mink Creek	ID16010202BR007_02 ID16010202BR007_03	2,765	4,537	2,765	0	413,677	4,136,241	413,677	0
Battle Creek	ID16010202BR015_02 ID16010202BR015_03 ID16010202BR015_04	1,916	284	284	85	1,619,864	259,202	259,202	84
Deep Creek	ID16010202BR006_02a	5,090	2,145	2,145	58	3,884,519	1,955,567	1,955,567	50
Fivemile Creek	ID16010202BR019_02 ID16010202BR019_02a	314	152	152	52	64,708	138,583	64,708	0
Weston Creek	ID16010202BR020_02 ID16010202BR020_02a ID16010202BR020_02c ID16010202BR020_03 ID16010202BR020_04	1,278	577	577	55	432,441	525,737	432,441	0
Malad River at 3700 S	ID16010204BR001_04	418	373	373	11	218,098	339,860	218,098	0
Malad River at ID-UT state line	ID16010204BR001_04	5,971	5,535	5,535	7	6,275,791	5,045,955	5,045,955	20

Assessment Unit Name	Assessment Unit Number	Existing Load	Target Load	Load Allocation	% Reduction to Meet Load Allocation	Existing Load	Target Load	Load Allocation	% Reduction to Meet Load Allocation
		kilograms per year total phosphorus				kilograms per year total suspended solids			
Little Malad River	ID16010204BR008_03 ID16010204BR008_04	347	214	214	38	88,118	194,958	88,118	0
Wright Creek	ID16010204BR010_02a ID16010204BR010_02b ID16010204BR010_03 ID16010204BR010_04	366	175	175	52	147,213	159,725	147,213	0
Elkhorn Creek	ID16010204BR008_02a	46	74	46	0	60,495	67,418	60,495	0
Devil Creek	ID16010204BR002_02 ID16010204BR002_03	98	67	67	32	11,854	61,308	11,854	0
Deep Creek	ID16010204BR006_03 ID16010204BR007_02 ID16010204BR007_03	23	70	23	0	4,335	64,037	4,335	0

2.5 Margin of Safety

To account for uncertainty associated with the relationship between pollutant loads and beneficial use impairment, a margin of safety (MOS) is included in the load analyses. For the Bear River basin, conservative targets were chosen, which include an inherent MOS. The 0.075 mg/L target TP concentrations was below EPA's recommendation of 0.1 mg/L. Target concentrations of sediment (35, 60, 80 mg/L TSS) fall within the range of concentrations (25–80 mg/L) necessary to maintain a good-to-moderate fishery.

2.6 Seasonal Variation

Seasonal variability was built into the sediment TMDLs by allowing for higher sediment concentrations during runoff periods when streams naturally carry more sediment associated with high flows. No change in TP targets were recommended based on seasonality because excess phosphorus adsorbed to sediments may be rereleased to the stream during periods of vegetation growth.

2.7 Reserve

No load allocations were held in reserve in the Bear River TMDL. If the target load was greater than the existing load, the load allocation was set at the existing load to not allow for additional pollution in the water body.

3 Beneficial Use Status

Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing, designated, and presumed uses. The *Water Body Assessment Guidance* (Grafe et al. 2002) gives a detailed description of beneficial use identification for assessment purposes.

Existing uses under the CWA are "those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards." Designated uses are specifically listed for water bodies in Idaho (IDAPA 58.01.02.110–160) in addition to citations for existing and presumed uses.

Undesignated uses are to be designated. In the interim, and absent information on existing uses, DEQ presumes that most waters in the state will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these so-called *presumed uses*, DEQ will apply the numeric cold water aquatic life criteria and primary or secondary contact recreation criteria to undesignated waters.

3.1 Beneficial Uses

Designated beneficial uses in the Bear River subbasin for AUs with 2006 TMDLs are shown in Table 4. All other tributaries that do not have designated beneficial uses are presumed to support cold water aquatic life and secondary contact recreation.

Table 4. Designated beneficial uses of water bodies with TMDLs approved in 2006.

Assessment Unit Name	Assessment Unit Number	Designated Beneficial Uses
Bear River—Idaho-Wyoming border to railroad bridge	ID16010102BR001_05	Cold water aquatic life, salmonid spawning, primary contact recreation
Thomas Fork—Idaho-Wyoming border to mouth	ID16010102BR003_04	Cold water aquatic life, salmonid spawning, primary contact recreation
Alexander Reservoir—Bear River	ID16010201BR001_0L	Cold water aquatic life, salmonid spawning, primary contact recreation
Bear River—Railroad bridge to Alexander Reservoir	ID16010201BR002_05 ID16010201BR002_06	Cold water aquatic life, salmonid spawning, primary contact recreation
Bailey Creek—Source to mouth	ID16010201BR003_02 ID16010201BR003_02a	Cold water aquatic life, salmonid spawning, secondary contact recreation
Eightmile Creek—Source to mouth	ID16010201BR004_02 ID16010201BR004_03 ID16010201BR004_03a	Cold water aquatic life, salmonid spawning, secondary contact recreation
Pearl Creek—Source to mouth	ID16010201BR005_02 ID16010201BR005_02a	Cold water aquatic life, salmonid spawning, secondary contact recreation
Stauffer Creek—Source to mouth	ID16010201BR006_02c ID16010201BR006_02d ID16010201BR006_03	Cold water aquatic life, salmonid spawning, secondary contact recreation
Skinner Creek—Source to mouth	ID16010201BR002_02c ID16010201BR007_02 ID16010201BR007_02a	Cold water aquatic life, salmonid spawning, secondary contact recreation
Georgetown Creek—Source to mouth	ID16010201BR022_02 ID16010201BR022_02b ID16010201BR022_03a	Cold water aquatic life, salmonid spawning, secondary contact recreation, domestic water supply
Soda Creek—Soda Creek Reservoir Dam to Alexander Reservoir	ID16010201BR023_02a ID16010201BR023_02b	Secondary contact recreation
Soda Creek Reservoir	ID16010201BR024_02	Secondary contact recreation
Soda Creek—Source to Soda Creek Reservoir	ID16010201BR025_02	Secondary contact recreation
Cub River—US Highway 91 bridge to Idaho-Utah border	ID16010202BR022_04	Cold water aquatic life, secondary contact recreation
Cub River—From and including Sugar Creek to US Highway 91 Bridge	ID16010202BR003_03	Cold water aquatic life, primary contact recreation
Worm Creek—Source to Idaho-Utah border	ID16010202BR005_02b	Cold water aquatic life, secondary contact recreation
Bear River—Oneida Narrows Reservoir Dam to Idaho-Utah border	ID16010202BR006_06	Cold water aquatic life, salmonid spawning, primary contact recreation

Assessment Unit Name	Assessment Unit Number	Designated Beneficial Uses
Mink Creek—Source to mouth	ID16010202BR007_03	Cold water aquatic life, salmonid spawning, primary contact recreation
Oneida Narrows Reservoir	ID16010202BR008_0L	Cold water aquatic life, salmonid spawning, primary contact recreation
Bear River—Alexander Reservoir Dam to Oneida Narrows Reservoir	ID16010202BR009_06a	Cold water aquatic life, salmonid spawning, primary contact recreation
Battle Creek—Source to mouth	ID16010202BR015_02 ID16010202BR015_03	Cold water aquatic life, secondary contact recreation
Malad River—Little Malad River to Idaho-Utah border	ID16010204BR001_04	Cold water aquatic life, secondary contact recreation
Little Malad River—Daniels Reservoir to mouth	ID16010204BR008_04	Cold water aquatic life, primary contact recreation
Wright Creek—Source to Daniels Reservoir	ID16010204BR010_02b ID16010204BR010_03 ID16010204BR010_04	Cold water aquatic life, salmonid spawning, primary contact recreation
Malad River—Source to Little Malad River	ID16010204BR012_02	Cold water aquatic life, primary contact recreation, domestic water supply

Beneficial uses are protected by a set of criteria, which include *narrative* criteria for pollutants such as sediment and nutrients and *numeric* criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity (IDAPA 58.01.02.250). Table 5 includes the most common numeric criteria used in TMDLs; Figure 6 provides an outline of the stream assessment process for determining support status of the beneficial uses of cold water aquatic life, salmonid spawning, and contact recreation.

Table 5. Common numeric criteria supportive of designated beneficial uses in Idaho water quality standards.

Parameter	Primary Contact Recreation	Secondary Contact Recreation	Cold Water Aquatic Life	Salmonid Spawning[a]
Water Quality Standards: IDAPA 58.01.02.250–251				
Bacteria				
• Geometric mean	<126 *E. coli*/100 mL[b]	<126 *E. coli*/100 mL	—	—
• Single sample	≤406 *E. coli*/100 mL	≤576 *E. coli*/100 mL	—	—
pH	—	—	Between 6.5 and 9.0	Between 6.5 and 9.5
Dissolved oxygen (DO)	—	—	DO exceeds 6.0 milligrams/liter (mg/L)	**Water Column DO**: DO exceeds 6.0 mg/L in water column or 90% saturation, whichever is greater **Intergravel DO**: DO exceeds 5.0 mg/L for a 1-day minimum and exceeds 6.0 mg/L for a 7-day average
Temperature[c]	—	—	22 °C or less daily maximum; 19 C or less daily average **Seasonal Cold Water**: Between summer solstice and autumn equinox: 26 °C or less daily maximum; 23 °C or less daily average	13 °C or less daily maximum; 9 °C or less daily average **Bull Trout**: Not to exceed 13 °C maximum weekly maximum temperature over warmest 7-day period, June–August; not to exceed 9 °C daily average in September and October
Turbidity	—	—	Turbidity shall not exceed background by more than 50 nephelometric turbidity units (NTU) instantaneously or more than 25 NTU for more than 10 consecutive days.	—
Ammonia	—	—	Ammonia not to exceed calculated concentration based on pH and temperature.	—
EPA Bull Trout Temperature Criteria: Water Quality Standards for Idaho, 40 CFR Part 131				
Temperature	—	—	—	7-day moving average of 10 °C or less maximum daily temperature for June–September

[a] During spawning and incubation periods for inhabiting species
[b] *Escherichia coli* per 100 milliliters
[c] Temperature exemption: Exceeding the temperature criteria will not be considered a water quality standard violation when the air temperature exceeds the ninetieth percentile of the 7-day average daily maximum air temperature calculated in yearly series over the historic record measured at the nearest weather reporting station.

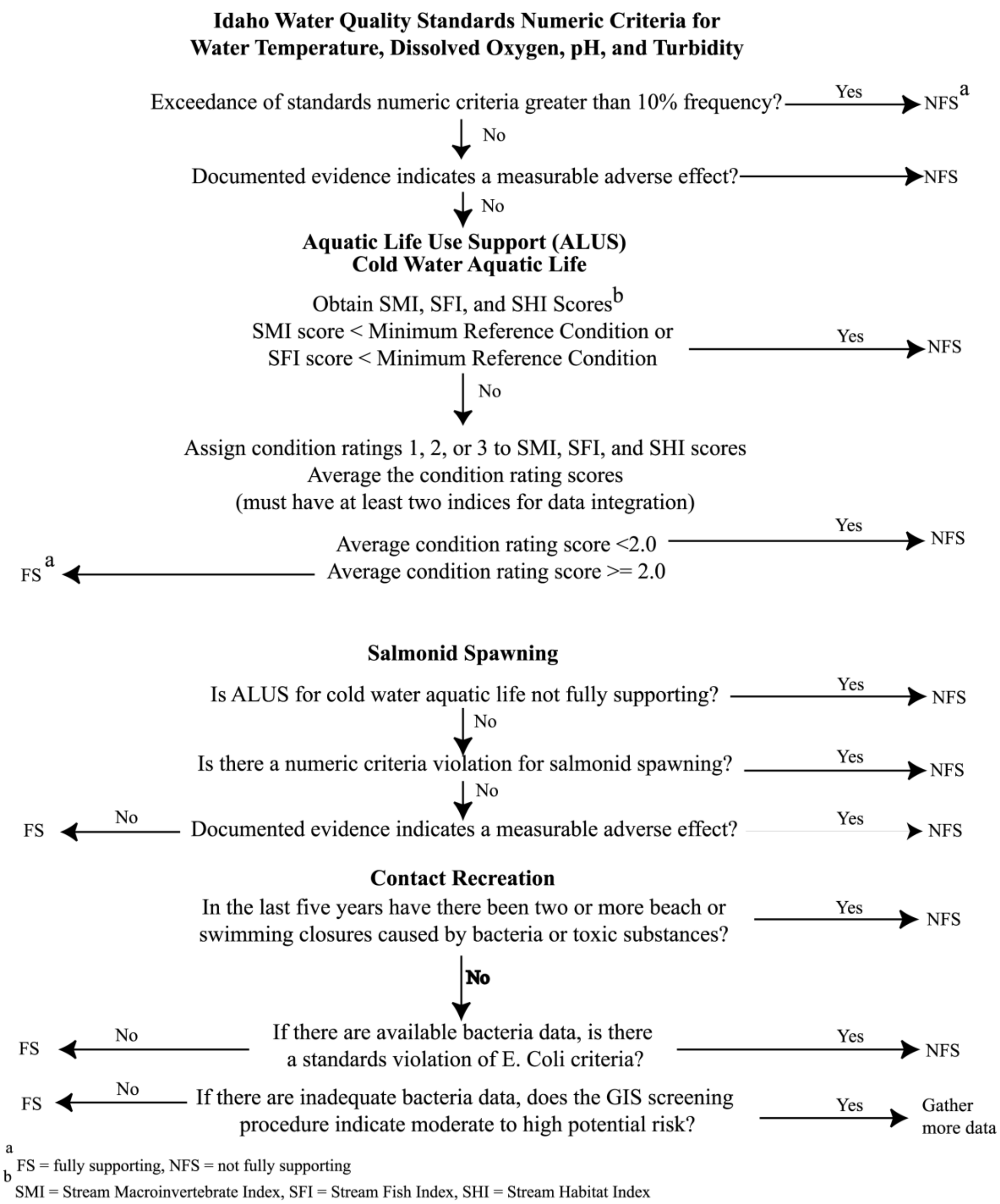


Figure 6. Determination steps and criteria for determining support status of beneficial uses in wadeable streams (Grafe et al. 2002).

3.2 Changes to Subbasin Characteristics

The Bear River basin in Idaho includes portions of Bear Lake, Caribou, Franklin, Bannock, and Oneida Counties. The Bear River enters Idaho in Bear Lake County from the Cokeville, Wyoming, area. Cities include Bloomington, Georgetown, Montpelier, Paris, and St. Charles. The population of the county decreased 6.6% between 2000 and 2010 from 6,411 to 5,986. As the Bear River flows north out of Bear Lake County, it enters Caribou County near its confluence with Eightmile Creek. Caribou County includes the cities of Bancroft, Grace, and Soda Springs and from 2000 to 2010 also decreased in population. Caribou County’s population went from 7,304 in 2000 to 6,963 in 2010, a decrease of nearly 5%. After exiting Alexander

Reservoir near Soda Springs, the Bear River flows south through the Gentile Valley and enters Franklin County at Thatcher, Idaho. Franklin County includes the cities of Clifton, Dayton, Franklin, Oxford, Preston, and Weston. While neighboring counties decreased in population from 2000 to 2010, Franklin County increased nearly 13% from 11,329 to 12,786. The Lower Bear/Malad HUC (16010204) is mainly contained in Oneida County. The only incorporated city in the county is Malad. Between the 2000 and 2010 census, Oneida County increased 4% in population from 4,125 to 4,286.

PacifiCorp Hydroelectric Operations

PacifiCorp operates the 107-megawatt Bear River Project in Caribou and Franklin Counties that consists of three developments. The Soda Development is a 103-foot high concrete dam that impounds the Bear River at Alexander Reservoir near Soda Springs, Idaho. The powerhouse has a 14-megawatt capacity. The Grace Development includes a 51-foot high timber crib dam that impounds 250 acres in the Grace forebay. Water is directed down a 26,000-foot long flowline (pipe) to a powerhouse with a capacity of 33 megawatts. The Oneida Development consists of a 111-foot high concrete dam that creates Oneida Reservoir. A 2,240-foot flowline is attached to a powerhouse with a capacity of 30 megawatts. The Federal Energy Regulatory Commission approved a Settlement Agreement in 2003 relicensing the Bear River Project for 30 years. The Environmental Coordination Committee (ECC) is a stakeholder group of signatories to the agreement that consults and decides on the use of funding and other license requirements of the Bear River Project (PacifiCorp 2015).

The new license requires the provisions of recreation enhancements, minimum instream flows to benefit aquatic resources, funds to conserve and benefit natural resources within a defined action area, and other measures related to land management, protection of cultural resources, and restoration of Bonneville Cutthroat Trout (BCT). As part of the Settlement Agreement, a fourth hydroelectric power plant, Cove, was decommissioned in 2006 (PacifiCorp 2007). Cove Dam used to be directly below the Grace Generation Facility. Other major accomplished activities by the ECC have been reported in annual summaries of license implementation and compliance.

3.3 Summary and Analysis of Current Water Quality Data

3.3.1 Beneficial Use Reconnaissance Program Data

DEQ’s BURP collects data on AUs to determine support of beneficial uses in subbasins throughout the state. Evaluations of BURP data are based on three facets of the ecology of wadeable streams: macroinvertebrates, stream habitat, and fish. Individual metrics within each category are used to generate a multimetric index scores. The multimetric index scores are the stream macroinvertebrate index (SMI), stream habitat index (SHI), and stream fish index (SFI). From those scores, condition rankings of 0, 1, 2, or 3 are assigned to sites based on percentile categories of reference conditions. At least two scores are needed to evaluate a stream’s support status; those scores must average 2 or greater (on a scale of 0 to 3) for beneficial uses to be considered supported.

The four HUCs in Idaho’s Bear River basin contain 242 AUs of which 131 have been surveyed by BURP since the monitoring program began in 1993 through 2013. Of the AUs in the Bear

River Basin that have been surveyed by BURP, 37% have been surveyed once, 27% have been surveyed twice, and 26% have been surveyed 3 times. The remaining 10% of AUs surveyed by BURP have been surveyed on four or more occasions (Figure 7). One St. Charles Creek AU (ID16010201BR016_03b) has been surveyed by BURP on 10 occasions.

The 2006 TMDL covered 85 AUs, of which 54 have been surveyed by BURP. Many of the AUs have been surveyed only once at the beginning of the program. Of the 54 AUs under the 2006 TMDL that have been surveyed, 36 have not been surveyed since 2005. Many of these AUs are contained on private land and access to survey these AUs has not been obtained.

Most AUs have been surveyed only 1–3 times in BURP's 20-year history, so it is difficult to discern water quality trends over time using BURP data. Because specific BURP sites are not repeated, it is difficult to distinguish if differing scores for the same AU are due to changing watershed conditions or site-specific attributes. Proper site selection that is characteristic of the AU is important for providing a representative assessment of water quality.

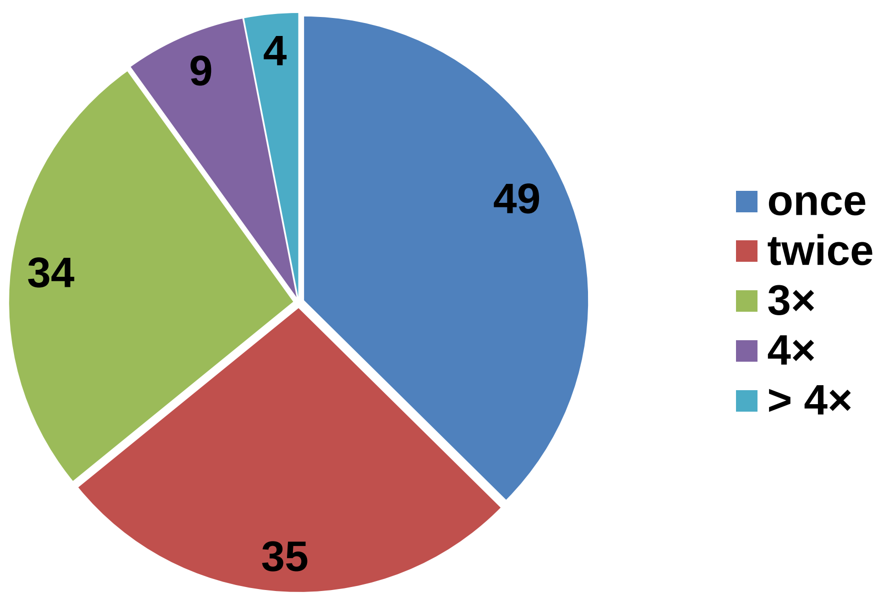


Figure 7. Number of BURP surveys conducted on AUs in the Bear River basin from 1993 to 2013.

BURP scores on AUs under 2006 TMDLs have varied by year (Table 6). It is difficult to discern if scores have improved since TMDL approval because the number of annual surveys since 2006 has been low. For example, no surveys were conducted on these AUs in 2008 and 2009 as the program was suspended and only one survey was conducted in 2010 and 2011. In 2012 and 2013 mean BURP scores tended to be quite high. Many of these surveys, however, were conducted in the upper portion of watersheds and on United States Forest Service (USFS) land. BURP scores demonstrate that many of these AUs were never impaired.

Table 6. Mean BURP scores for AUs under 2006 TMDLs by year.

Year	Mean SMI Score	Mean SMI Rating	n	Mean SFI Score	Mean SFI Rating	n	Mean SHI Score	Mean SHI Rating	n	Average Multimetric Score
1994	65.2	2.8	9	--	--	0	43.0	1.4	9	2.0
1995	36.4	0.9	24	75.2	2.2	9	48.0	1.6	24	1.0
1996	32.1	0.8	8	51.3	1.0	2	43.4	1.4	8	0.6
1997	37.4	0.8	11	61.5	1.4	5	47.2	1.5	11	0.6
1998	46.5	1.5	12	--	--	0	48.8	1.6	12	1.4
1999	34.0	0.8	6	16.9	0.0	1	49.8	1.7	6	0.8
2000	—	—	0	—	—	0	—	—	0	—
2001	43.7	1.2	10	75.2	2	2	44.7	1.4	10	1.2
2002	50.8	2.0	8	37.5	0	1	48.9	1.8	8	1.8
2003	37.7	0.9	7	68.5	2	1	46.6	1.4	7	0.8
2004	51.0	1.8	5	40.7	1	1	61.6	2.2	5	1.9
2005	44.4	1.0	4	—	—	0	51.0	1.5	4	0.8
2006	48.2	2.0	5	—	—	0	50.2	1.6	5	1.7
2007	71.3	2.7	3	—	—	0	56.3	2.0	3	2.3
2008	—	—	0	—	—	0	—	—	0	—
2009	—	—	0	—	—	0	—	—	0	—
2010	66.1	3.0	1	—	—	0	70.0	3.0	1	3.0
2011	63.4	3.0	1	86.6	3.0	1	71.0	3.0	1	3.0
2012	49.9	2.0	5	67.2	1.8	4	65.2	2.6	5	1.9
2013	59.5	2.3	6	68.4	1.8	6	63.0	2.2	6	2.1

Notes: Stream macroinvertebrate index (SMI); stream habitat index (SHI); and stream fish index (SFI). n = number of BURP surveys.

While annual BURP scores on AUs under the 2006 TMDL do not demonstrate improving water quality, these data identified some AUs that appear to be supporting their beneficial uses (Table 7) These AUs were included in the 2006 TMDL because they were a part of the Bear River tributary that was contributing excess sediment or nutrients to the river. Their biological and ecological attributes showed no impairment, and they should be placed in Category 2 in the next Integrated Report.

In the Bear Lake subbasin, several headwaters to impaired water bodies are fully supporting beneficial uses. Upper Bailey Creek (ID16010201BR003_02a) was surveyed by BURP in 1994, 2004, and 2012. All scores are ≥2 and indicate full support of cold water aquatic life. In the 2012 survey, electrofishing surveys documented 29 Brook Trout including juveniles <100 millimeters (mm), indicating that salmonid spawning is an existing use. Upper Bailey Creek is fully contained on USFS land.

Upper Eightmile Creek (ID16010201BR004_02) was monitored by BURP in 1994, 1997, and 2013. All scores were ≥2 and indicate that cold water aquatic life is fully supported. A 2013 electrofishing survey documented 17 Brook Trout and 16 sculpin. Some of the Brook Trout were <100 mm, indicating that salmonid spawning is an existing use.

North and South Forks Stauffer Creek (ID16010201BR006_02c) was monitored by BURP in 1995, 2002, and 2007. Average scores were 3, indicating full support of cold water aquatic life. In a 1995 electrofishing survey, native Cutthroat Trout were documented.

Table 7. BURP scores (1993–2013) for AUs with approved TMDLs (2002 and 2007) in the Bear River basin.

Assessment Unit Name	Assessment Unit Number	BURP ID	SMI Score	SMI Rating	SFI Score	SFI Rating	SHI Score	SHI Rating	Average
Bear River	ID16010102BR001_05	1998 Wyoming Border	—	2	—	—	—	1[c]	1.5
		1998 Dingle Bridge	—	2	—	1	—	2	1.67
		2005RPOCA025	—	0	—	—	—	—	—
Thomas Fork	ID16010102BR003_04	1995SPOCA033	31.21	0	—	—	38	1	0
		1995SPOCS034	44.57	2	—	—	34	1	1.5
		2001SPOCA037	56.47	2	—	—	38	1	1.5
		2006SPOCA040	65.22	3	—	—	60	2	2.5
Sheep Creek	ID16010102BR008_02	1998SPOCA069	51.59	2	—	—	32	1	1.5
		1999SPOCA039	42.44	1	—	—	39	1	1
		2003SPOCA037	24.64	0	—	—	18	1	0
Sheep Creek	ID16010102BR008_03	No BURP data	—	—	—	—	—	—	—
Alexander Reservoir	ID16010201BR001_0L	No BURP data	—	—	—	—	—	—	—
Sulphur Canyon	ID16010201BR002_02a	1999SPOCA049	54.50	3	—	—	57	2	2.5
		2004SPOCA072	51.01	2	—	—	52	1	1.5
Lower Skinner Creek	ID16010201BR002_02c	1997SPOCA071	83.83	3	—	—	43	1	2
Bear River	ID16010201BR002_05	No BURP data	—	—	—	—	—	—	—
Bear River	ID16010201BR002_06[b]	No BURP data	—	—	—	—	—	—	—
Lower Bailey Creek	ID16010201BR003_02	No BURP data	—	—	—	—	—	—	—
Upper Bailey Creek	ID16010201BR003_02a[a]	1994SPOCA035	51.70	3	—	—	51	2	2.5
		2004SPOCA071	63.37	3	—	—	64	2	2.5
		2012SPOCA038	58.20	2	50	1	68	3	2
Eightmile Creek	ID16010201BR004_02[a]	1994SPOCA036	79.93	3	—	—	58	2	2.5
		1997SPOCA045	41.93	1	—	—	69	3	2
		2013SPOCA005	50.19	1	81.67	3	72	3	2.33
South Wilson Creek	ID16010201BR004_02a	1999SPOCA043	13.88	0	—	—	40	1	0
Eightmile Creek	ID16010201BR004_03	1994SPOCA037	58.42	3	—	—	34	1	2
		1997SPOCA046	49.50	1	51	1	47	1	1
		2013SPOCA076	56.87	3	65.13	1	58	2	2
Lower Pearl Creek	ID16010201BR005_02	No BURP data	—	—	—	—	—	—	—

Assessment Unit Name	Assessment Unit Number	BURP ID	SMI Score	SMI Rating	SFI Score	SFI Rating	SHI Score	SHI Rating	Average
Middle Pearl Creek	ID16010201BR005_02a	1995SPOCA021	41.57	1	—	—	49	1	1
		1995SPOCA022	67.77	3	—	—	79	3	3
		2001SPOCA031	73.66	3	—	—	56	1	2
North and South Forks Stauffer Creek	ID16010201BR006_02c[a]	1995SPOCA027	64.52	3	96.68	3	70	3	3
		2002SPOCA059	78.88	3	—	—	75	3	3
		2007SPOCB069	85.81	3	—	—	75	3	3
Stauffer Creek	ID16010201BR006_02d[a]	1995SPOCA026	56.39	3	88.42	3	72	3	3
		2002SPOCA060	77.94	3	—	—	49	1	2
		2007SPOCB068	81.75	3	—	—	57	2	2.5
Lower Stauffer Creek	ID16010201BR006_03	1994SPOCA043	62.09	3	—	—	23	1	2
		1995SPOCA025	29.53	0	31.23	0	48	1	0
		2002SPOCA061	55.51	2	—	—	28	1	1.5
		2007SPOCB070	46.20	2	—	—	37	1	1.5
Skinner Creek	ID16010201BR007_02	No BURP data	—	—	—	—	—	—	—
North and South Forks Skinner Creek	ID16010201BR007_02a[a]	1994SPOCA042	91.82	3	—	—	78	3	3
		1997SPOCA070	21.48	0	—	—	78	3	0
		2003SPOCA033	76.77	3	—	—	78	3	3
		2012SPOCA028	65.22	3	79.94	2	77	3	2.67
Ovid Creek	ID16010201BR009_04	1996SPOCA054	8.51	0	—	—	34	1	0
		2001SPOCA034	27.69	0	—	—	27	1	0
		2006SPOCA043	25.59	0	—	—	30	1	0
Right-Hand Fork Georgetown Creek	ID16010201BR022_02a	1999SPOCA042	27.41	0	—	—	51	2	0
Upper Georgetown Creek	ID16010201BR022_02b[a]	1994SPOCA040	63.68	3	—	—	46	1	2
		1994SPOCA041	75.45	3	—	—	42	1	2
		1997SPOCA042	58.75	2	—	—	63	2	2
		1997SPOCA043	51.85	2	31.32	0	45	1	0
		2004SPOCA073	51.66	2	—	—	58	2	2
		2004SPOCA074	48.87	1	—	—	70	3	2
		2010SDEQA2101	66.13	3	—	—	70	3	3
		2012SPOCA039	59.75	3	50.00	1	75	3	2.33

Assessment Unit Name	Assessment Unit Number	BURP ID	SMI Score	SMI Rating	SFI Score	SFI Rating	SHI Score	SHI Rating	Average
		2013SPOCA052	63.46	3	46.20	1	65	2	2
Lower Georgetown Creek	ID16010201BR022_03a	1997SPOCA044	24.44	0	65.15	1	55	2	0
Soda Creek	ID16010201BR023_02a	1999SPOCA050	41.38	1	—	—	61	2	1.5
		2005SPOCA076	22.63	0	—	—	36	1	0
		2005SPOCA077	46.21	1	—	—	42	1	1
Lower Soda Creek	ID16010201BR023_02b	1999SPOCA051	24.33	0	16.86	0	51	2	0
		2005SPOCA075	32.15	0	—	—	54	1	0
		2012SPOCA023	23.55	0	—	—	52	2	0
Soda Creek Reservoir	ID16010201BR024_02	No BURP data	—	—	—	—	—	—	—
Soda Creek	ID16010201BR025_02	No BURP data	—	—	—	—	—	—	—
Cub River	ID16010202BR002_04	1996SPOCA051	44.20	1	44.25	1	50	1	1
		2001SPOCA040	38.46	1	—	—	47	1	1
Cub River	ID16010202BR003_02	No BURP data	—	—	—	—	—	—	—
Maple Creek	ID16010202BR003_02a[a]	1995SPOCA062	56.39	2	91.60	3	71	3	2.67
		2011SPOCA010	63.41	3	86.63	3	71	3	3
Cub River	ID16010202BR003_03	No BURP data	—	—	—	—	—	—	—
Maple Creek	ID16010202BR003_03a	1995SPOCA068	85.52	3	—	—	69	3	3
		2001SPOCA042	87.66	3	—	—	87	3	3
Worm Creek	ID16010202BR005_02	No BURP data	—	—	—	—	—	—	—
Lower Worm Creek	ID16010202BR005_02b	1996SPOCA027	22.27	0	—	—	24	1	0
		2001SPOCA041	11.67	0	—	—	14	1	0
Station Creek	ID16010202BR006_02	2013SPOCA088	68.78	3	69.70	2	61	2	2.33
		2013SPOCA089	35.79	1	79.60	2	49	1	1.33
Deep Creek	ID16010202BR006_02a	1995SPOCA067	25.47	0	85.12	3	31	1	0
		2001SPOCA045	37.88	1	—	—	34	1	1
		2012SPOCA030	43.02	2	88.72	3	54	2	2.33
Bear River	ID16010202BR006_06[b]	1998	—	—	—	—	—	—	—
		2005RPOCA020	—	3	—	—	—	—	—
		2005RPOCA021	—		—	—	—	—	—

Assessment Unit Name	Assessment Unit Number	BURP ID	SMI Score	SMI Rating	SFI Score	SFI Rating	SHI Score	SHI Rating	Average
Birch Creek	ID16010202BR007_02[a]	1996SPOCA034	67.58	3	58.37	1	71	3	2.33
		2002SPOCA028	63.78	3	—	—	85	3	3
		2005SPOCA070	76.48	3	—	—	72	3	2
		2013SPOCA070	81.86	3	68.26	2	73	3	2.67
Mink Creek	ID16010202BR007_03	1995SPOCA063	53.25	2	74.81	2	55	1	1.67
		2002SPOCA027	43.42	2	—	—	68	3	2.5
		2004SPOCA042	39.87	1	40.67	1	64	3	1.67
Oneida Narrows Reservoir	ID16010202BR008_0L	No BURP data	—	—	—	—	—	—	—
Unnamed tributaries	ID16010202BR009_02	No BURP data	—	—	—	—	—	—	—
Smith Creek	ID16010202BR009_02a	1998SPOCA051	44.82	2	—	—	75	3	2.5
		2003SPOCA021	28.44	0	—	—	47	1	0
Alder Creek	ID16010202BR009_02b	1998SPOCA050	69.66	3	—	—	75	3	3
Burton Creek	ID16010202BR009_02c	1998SPOCA049	69.54	3	—	—	53	2	2.5
Bear River	ID16010202BR009_06	1998	—	—	—	—	—	—	—
		2005RPOCA022	—	3	—	—	—	—	—
		2005RPOCA025	—	3	—	—	—	—	—
Bear River	ID16010202BR009_06a	1998 Caribou- Franklin county line	—	2	—	—	—	—	—
		1998 Highway 36	—	2	—	—	—	1[c]	1.5
		2005RPOCA026	—	3	—	—	—	—	—
		2008							
Williams Creek	ID16010202BR010_02	No BURP data	—	—	—	—	—	—	—
Williams Creek	ID16010202BR010_02a	1995SPOCA019	24.98	0	—	—	36	1	0
		1995SPOCA020	44.45	1	—	—	82	3	2
		2001SPOCA012	36.85	1	94.38	3	78	3	2.33
Trout Creek	ID16010202BR011_02	No BURP data	—	—	—	—	—	—	—
Trout Creek	ID16010202BR011_03	1995SPOCA018	21.22	0	—	—	37	1	0
Whiskey Creek	ID16010202BR012_02	1995SPOCA012	11.82	0	—	—	30	1	0
		2001SPOCA014	34.71	1	55.98	1	36	1	1

Assessment Unit Name	Assessment Unit Number	BURP ID	SMI Score	SMI Rating	SFI Score	SFI Rating	SHI Score	SHI Rating	Average
Densmore Creek	ID16010202BR013_02	1995SPOCA011	14.06	0	—	—	35	1	0
		1995SPOCA017	10.23	0	—	—	39	1	0
Cottonwood Creek	ID16010202BR014_04	1995SPOCA015	27.02	0	43.18	1	41	1	0
		1995SPOCA016	34.21	1	92.99	3	61	2	2
Battle Creek	ID16010202BR015_02	2006SPOCA016	50.85	2	—	—	57	2	2
Battle Creek	ID16010202BR015_03	No BURP data	—	—	—	—	—	—	—
Battle Creek	ID16010202BR015_04	1995SPOCA065	20.36	0	—	—	40	1	0
		1995SPOCA066	27.39	0	—	—	28	1	0
		2001SPOCA044	31.64	0	—	—	30	1	0
Fivemile Creek	ID16010202BR019_02	1996SPOCA029	26.86	0	—	—	61	2	0
Fivemile Creek	ID16010202BR019_02a	1998SPOCA095	15.92	0	—	—	45	1	0
		2003SPOCA023	31.02	0	—	—	43	1	0
Weston Creek	ID16010202BR020_02	No BURP data	—	—	—	—	—	—	—
Black Canyon	ID16010202BR020_02a	1998SPOCA035	35.59	1	—	—	39	1	1
Upper Weston Creek	ID16010202BR020_02c	1998SPOCA038	31.68	0	—	—	47	1	0
Weston Creek	ID16010202BR020_02d	1998SPOCA037	30.27	0	—	—	19	1	0
Weston Creek	ID16010202BR020_03	1995SPOCA069	38.44	1	72.91	2	65	2	1.67
Malad River	ID16010204BR001_04	1995SPOCA071	10.52	0	—	—	3	1	0
		1997SPOCB013	12.79	0	—	—	12	1	0
		2002SPOCA023	17.91	0	37.47	0	6	1	0
Devil Creek	ID16010204BR002_02	No BURP data	—	—	—	—	—	—	—
Campbell Creek	ID16010204BR002_02a	1998SPOCA024	40.99	1	—	—	48	1	1
Evans Creek	ID16010204BR002_02c	1998SPOCA026	49.63	2	—	—	29	1	1.5
Deep Creek	ID16010204BR002_03	1997SPOCA010	25.86	0	—	—	33	1	0
		2003SPOCA007	18.96	0	—	—	42	1	0
Deep Creek	ID16010204BR005_03	1996SPOCA021	11.58	0	—	—	29	1	0
Susan Hollow	ID16010204BR006_02	1998SPOCA029	37.84	1	—	—	47	1	1
Deep Creek Reservoir	ID16010204BR006_03	No BURP data	—	—	—	—	—	—	—
Deep Creek	ID16010204BR007_02	No BURP data	—	—	—	—	—	—	—
Deep Creek	ID16010204BR007_03	No BURP data	—	—	—	—	—	—	—

Assessment Unit Name	Assessment Unit Number	BURP ID	SMI Score	SMI Rating	SFI Score	SFI Rating	SHI Score	SHI Rating	Average
Malad River	ID16010204BR008_02	No BURP data	—	—	—	—	—	—	—
Elkhorn Creek	ID16010204BR008_02a	1996SPOCA018	55.52	2	—	—	52	1	1.5
		1996SPOCA019	20.40	0	—	—	26	1	0
		2002SPOCA024	65.09	3	—	—	55	1	2
Malad River	ID16010204BR008_03	No BURP data	—	—	—	—	—	—	—
Little Malad River	ID16010204BR008_04	1995SPOCA070	32.07	0	—	—	40	1	0
		1997SPOCA011	16.78	0	68.61	2	33	1	0
		2002SPOCA025	3.61	0	—	—	25	1	0
Little Malad River	ID16010204BR009_02	No BURP data	—	—	—	—	—	—	—
Indian Mill Creek	ID16010204BR010_02a[a]	1998SPOCA031	80.56	3	—	—	77	3	3
		2003SPOCA019	59.55	3	—	—	54	2	2.5
Upper Wright Creek	ID16010204BR010_02b	No BURP data	—	—	—	—	—	—	—
Middle Wright Creek	ID16010204BR010_03	1994SPOCA044	38.67	1	67.97	2	32	1	1.33
		1997SPOCA013	23.64	0	91.60	3	41	1	0
		2006SPOCA073	45.82	2	—	—	46	1	1.5
		2006SPOCA074	53.52	3	—	—	58	2	2.5
Lower Wright Creek	ID16010204BR010_04	1994SPOCA045	33.47	1	—	—	23	1	1
		2003SPOCA011	24.70	0	68.47	2	44	1	0
Malad River	ID16010204BR012_02	No BURP data	—	—	—	—	—	—	—

a. Assessment unit appears to be supporting its beneficial use based on BURP scores ≥2.0.
b. Assessment unit sampled extensively as part of Boater Flow monitoring.
c. For river sites, SHI rating are replaced with River Diatom Index ratings.
Notes: Beneficial Use Reconnaissance Program (BURP); stream macroinvertebrate index (SMI); stream habitat index (SHI); and stream fish index (SFI).

Stauffer Creek (ID16010201BR006_02d) was surveyed by BURP in 1995, 2002, and 2007. All scores indicate that cold water aquatic life is being fully supported. The 1997 electrofishing survey documented native Cutthroat Trout.

North and South Forks Skinner Creek (ID16010201BR007_02a) was monitored by BURP in 1994, 1997, 2003, and 2012. All scores indicate full support except the 1997 score. In 1997, the SMI was zero because 479 of the 673 macroinvertebrates collected were the caddisfly (*Brachycentrus occidentalis*). The lack of diversity in macroinvertebrates is unexplained. In the ensuing BURP surveys, SMI scores were 3. In 2012, all four fish observed were native Cutthroat Trout, and two were <100 mm, indicating that salmonid spawning is an existing use. This AU is fully supporting cold water aquatic life.

Upper Georgetown Creek (ID16010201BR022_02b) has been the focus of nine BURP surveys. In all surveys except one in 1997, scores indicated full support of cold water aquatic life. In 1997, the SFI was zero and four Brook Trout were caught. Since eight other BURP surveys indicate full support of beneficial uses, this AU should be delisted for TP and TSS as it is fully supporting cold water aquatic life.

In the Middle Bear subbasin, upper Maple Creek (ID16010202BR003_02a) was monitored by BURP in 1995 and 2011. All scores indicate full support of cold water aquatic life. Both electrofishing surveys documented native Cutthroat Trout including individuals <100 mm, indicating that salmonid spawning is an existing use.

Birch Creek (ID16010202BR007_02) is a tributary to Mink Creek that has been surveyed by BURP four times. All scores indicate full support of cold water aquatic life. Electrofishing surveys documented native Cutthroat Trout, and the 1995 survey documented individuals <100 mm, indicating that salmonid spawning is an existing use.

In the Lower Bear/Malad subbasin, Indian Mill Creek (ID16010204BR010_02a) was monitored by BURP in 1998 and 2003. Both scores indicated full support of cold water aquatic life (average scores ≥2.5). This AU should be moved to Category 2 in the next Integrated Report.

Another aspect of the BURP program is sampling *E. coli* bacteria to determine a water body's support of its recreational beneficial use. In water bodies that are designated for primary contact recreation, samples above 406 cfu/100 mL trigger further sampling to generate a 5-sample geometric mean. In water bodies that are undesignated or designated for secondary contact recreation, samples above 576 cfu/100 mL trigger further sampling. In both cases if the geometric mean of five samples is above 126 cfu/100 mL, contact recreation is considered not supported. If the geometric mean is below 126 cfu/100 mL, contact recreation is considered to be fully supported. *E. coli* results for Central Bear, Bear Lake, Middle Bear, and Lower Bear/Malad are displayed in Table 8.

Some *E. coli* data were not reflected in the 2012 Integrated Report. In the Central Bear subbasin, Dry Creek (ID16010102BR005_02a) had a geometric mean of 603 cfu/100 mL in 2001. This AU should be resampled and placed on the §303(d) list if bacteria levels are still exceeding water quality standards.

Table 8. *E. coli* data for AUs in the HUCs under 5-year review.

Assessment Unit Name	Assessment Unit Number	Sample Location	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Geometric mean (cfu/ 100 mL)
Thomas Fork	ID16010102BR003_04	Within BURP reach (2006SPOCA040)	8/31/2006 68	—	—	—	—	—
Dry Creek	ID16010102BR005_02a[a]	On USFS land at 2nd road crossing	8/21/2001 550	8/27/2001 1,400	8/30/2001 1,100	9/4/2001 350	9/12/2001 270	603
Preuss Creek	ID16010102BR006_02	At lower road crossing (Boulevard Road)	8/21/2001 3	—	—	—	—	—
Preuss Creek	ID16010102BR006_02b	Within BURP reach (2006SPOCA019)	8/31/2006 78	—	—	—	—	—
Preuss Creek	ID16010102BR006_02b	42.46428 -111.17107	8/7/2014 19	—	—	—	—	—
Sheep Creek	ID16010102BR008_02	1/2-mile upstream of Sheep Creek Reservoir	8/28/2002 120	—	—	—	—	—
Bailey Creek	ID16010201BR003_02a	Below BURP site (2004SPOCA071) off Pioneer Road	9/1/2004 18	—	—	—	—	—
Bailey Creek	ID16010201BR003_02a	42.57117 -111.5924	8/11/2015 68	—	—	—	—	—
Mill Fork Eightmile Creek	ID16010201BR004_02	42.50208 -111.57895	8/11/2015 <1	—	—	—	—	—
Eightmile Creek	ID16010201BR004_03	<1 mile south of Bear River where Eightmile Road crosses creek	9/7/2000 90	—	—	—	—	—
Pearl Creek	ID16010201BR005_02[a]	Below BURP site (2004SPOCA071) off Pioneer Road	8/21/2001 1,400	8/27/2001 610	8/30/2001 2,000	9/4/2001 1,200	9/12/2001 200	837
Pearl Creek	ID16010201BR005_02b	At Skinner Canyon Road crossing	8/28/2002 270	—	—	—	—	—

Assessment Unit Name	Assessment Unit Number	Sample Location	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Geometric mean (cfu/ 100 mL)
Stauffer Creek (upper)	ID16010201BR006_02c	At BURP site (2007SPOCB069)	8/14/2007 10	—	—	—	—	—
Stauffer Creek	ID16010201BR006_02d[b]	At BURP site (2007SPOCB068)	8/8/2007 579	8/14/2007 387	8/20/2007 517	8/23/2007 250	8/27/2007 161	342
Stauffer Creek	ID16010201BR006_03[a]	3/4 miles northeast of Nounan Cemetery where Nounan Road crosses the creek	9/7/2000 740	9/11/2000 180	9/14/2000 500	9/18/2000 410	9/21/2000 100	307
Stauffer Creek (lower)	ID16010201BR006_03	1.5-mile downstream of BURP site (2007SPOCB070)	8/8/2007 120	—	—	—	—	—
Ovid Creek	ID16010201BR009_04	1 mile west of Bear River at Bern Road	9/7/2000 120	—	—	—	—	—
Ovid Creek	ID16010201BR009_04	Within BURP reach (2006SPOCA043)	8/31/2006 62	—	—	—	—	—
Emigration Creek	ID16010201BR010_02b	At BURP site (2007SPOCB034)	8/14/2007 2	—	—	—	—	—
North Creek	ID16010201BR010_03	East of Liberty at Poulson Road	8/21/2001 350	—	—	—	—	—
Mill Creek	ID16010201BR011_03[a]	West of Liberty at Lanark Road	8/21/2001 730	8/27/2001 93	8/30/2001 210	9/1/2001 65	9/12/2001 460	212
Paris Creek	ID16010201BR013_02	1 mile east of Paris at Struck Road crossing	9/7/2000 90	—	—	—	—	—
Sleight Canyon Creek	ID16010201BR013_02a	At Sleight Canyon Road crossing	8/28/2002 15	—	—	—	—	—
South Fork Bloomington	ID16010201BR014_02a	Within BURP site (2005SPOCA029)	8/16/2005 30	—	—	—	—	—
Bloomington Creek	ID16010201BR014_03	Approx, 3/4 miles east of Highway 89 cross irrigation ditch	9/7/2000 110	—	—	—	—	—
Bloomington Creek	ID16010201BR014_03	Within BURP reach (2006SPOCA041)	8/31/2006 39	—	—	—	—	—

Assessment Unit Name	Assessment Unit Number	Sample Location	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Geometric mean (cfu/ 100 mL)
North Fork St. Charles	ID16010201BR016_02a	At bottom of BURP reach (2008SPOCA012)	8/5/2008 275.5	—	—	—	—	—
Snowslide Canyon Creek	ID16010201BR016_02a	At bottom of BURP reach (2008SPOCA013)	8/5/2008 217.8	—	—	—	—	—
South Fork St. Charles	ID16010201BR016_02a	At bottom of BURP reach (2008SPOCA016)	8/5/2008 2	—	—	—	—	—
St. Charles Creek	ID16010201BR016_03a	Just above Highway 89 crossing	9/1/1999 <10	—	—	—	—	—
Little Creek	ID16010201BR016_03a	At 100 E, outside of St. Charles	8/28/2002 330	—	—	—	—	—
North Fork St. Charles	ID16010201BR016_03b	Below BURP site (2004SPOCA082) off Minnetonka Cave Road	8/31/2004 68	—	—	—	—	—
St. Charles	ID16010201BR016_03b	Below BURP site (2004SPOCA083) off Minnetonka Cave Road	8/31/2004 15	—	—	—	—	—
St. Charles Creek	ID16010201BR016_03b	42.11523 -111.44125	8/19/2014 119	—	—	—	—	—
Fish Haven Creek	ID16010201BR019_02a	Within BURP reach (2006SPOCA044)	8/31/2006 10	—	—	—	—	—
Montpelier Creek	ID16010201BR020_02	Above reservoir at Highway 89 crossing	8/21/2001 82	—	—	—	—	—
Whiskey Creek	ID16010201BR020_02b[b]	At USFS Road 114 crossing	8/21/2001 2,400	8/27/2007 2,400	8/30/2001 1,700	9/4/2001 350	9/12/2001 600	1,155

Assessment Unit Name	Assessment Unit Number	Sample Location	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Geometric mean (cfu/ 100 mL)
Home Canyon Creek	ID16010201BR020_02d	At road crossing just upstream of confluence with Montpelier Creek	8/21/2001 79	—	—	—	—	—
Home Canyon	ID16010201BR020_02d[b]	Below BURP (2004SPOCA078) site off Home Canyon Road	8/31/2004 > 2,400	9/3/2004 >2,400	9/7/2004 > 2,400	9/10/2004 > 2,400	9/14/2004 > 2,400	> 2,400
Snowslide Creek	ID16010201BR020_02f	From Crow Creek Road at lower end of 2001 BURP site	8/21/2001 38	—	—	—	—	—
Montpelier Creek	ID16010201BR020_03	Below BURP site (2004SPOCA043) near confluence with Bear River	9/1/2004 7	—	—	—	—	—
Lower Montpelier Creek	ID16010201BR020_03a	42.34282 -111.17655	8/7/2014 9	—	—	—	—	—
Georgetown Creek	ID16010201BR022_02b	Below BURP site (2004SPOCA074) off Georgetown Canyon Road	9/1/2004 4	—	—	—	—	—
Georgetown Creek	ID16010201BR022_03a[b]	East of railroad, where road crosses creek	9/7/2000 1,300	9/11/2000 290	9/14/2000 1,100	9/18/2000 500	9/21/2000 310	578
Lower Soda Creek	ID16010201BR023_02b	100 m above Highway 30 crossing	9/7/1999 7	—	—	—	—	—
Cub River (lower)	ID16010202BR002_04	Off spur road from E 5400 S	9/1/1999 320	—	—	—	—	—
Cub River (lower)	ID16010202BR002_04[a]	At road crossing near Franklin	8/25/2003 1,100	8/28/2003 550	9/2/2003 370	9/8/2003 1,300	9/15/2003 81	473
Maple Creek (Site 1)	ID16010202BR003_03a[c]	Just below Deep Creek confluence	9/1/1999 280	—	—	—	—	—
Maple Creek (Site 2)	ID16010202BR003_03a[c]	Below Site 1: at old wooden corral	9/1/1999 670	9/14/1999 560	9/21/1999 720	9/22/1999 190	9/23/1999 160	383

Assessment Unit Name	Assessment Unit Number	Sample Location	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Geometric mean (cfu/ 100 mL)
Cub River (upper)	ID16010202BR004_03	Just below confluence with Foster Creek	8/25/2003 33	—	—	—	—	—
Cub River	ID16010202BR004_03	Within BURP reach (2006SPOCA015)	9/7/2006 7	—	—	—	—	—
Worm Creek (lower)	ID16010202BR005_02b	At 4800 S	9/6/2000 98	—	—	—	—	—
Worm Creek	ID16010202BR005_02b	At road county crossing 2 miles west of Franklin	8/25/2003 230	—	—	—	—	—
Deep Creek	ID16010202BR006_02a	At N 2200 W 0.1 miles north of Squaw Springs	9/6/2000 120	—	—	—	—	—
Deep Creek	ID16010202BR006_02a	42.16745 -111.97135	7/1/2015 135	—	—	—	—	—
Birch Creek	ID16010202BR007_02	At Highway 36 crossing	9/6/2000 310	—	—	—	—	—
Birch Creek	ID16010202BR007_02	BURP site (2005SPOCA070)	8/15/2005 3	—	—	—	—	—
Strawberry Creek	ID16010202BR007_02a[a]	600 m upstream of confluence with Mink Creek	9/6/2000 780	9/11/2000 1,700	9/14/2000 1,100	9/18/2000 2,000	9/21/2000 480	1,070
Mink Creek	ID16010202BR007_03[a]	<100 m upstream of confluence with Bear River	9/6/2000 630	9/11/2000 110	9/14/2000 86	9/18/2000 100	9/21/2000 70	133
Mink Creek	ID16010202BR007_03	Below BURP site (2004SPOCA042) upstream of east Riverdale Road	9/2/2004 140	—	—	—	—	—
Smith Creek	ID16010202BR009_02a[a]	Just above River Road	9/1/1999 460	9/14/1999 700	9/21/1999 1,000	9/22/1999 200	9/23/1999 120	378
Smith Creek	ID16010202BR009_02a	At River Road	9/7/2000 20	—	—	—	—	—

Assessment Unit Name	Assessment Unit Number	Sample Location	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Geometric mean (cfu/ 100 mL)
Alder Creek	ID16010202BR009_02b[b]	At River Road	9/1/1999 660	9/14/1999 560	9/21/1999 1,700	9/22/1999 680	9/23/1999 530	743
Burton Creek	ID16010202BR009_02c	At Thatcher Cemetery Road	9/1/1999 350	—	—	—	—	—
Burton Creek	ID16010202BR009_02c	At River Road	9/7/2000 110	—	—	—	—	—
Trout Creek	ID16010202BR011_02	42.45722 - 111.657383	8/11/2015 <1	—	—	—	—	—
Trout Creek	ID16010202BR011_03	South of Thatcher on Highway 34 where creek passes under road	9/7/2000 270	—	—	—	—	—
Whiskey Creek	ID16010202BR012_02	At Highway 34 crossing	8/23/2001 280	—	—	—	—	—
Blue Creek	ID16010202BR014_02b	BURP site (2005SPOCA067)	8/15/2005 115	—	—	—	—	—
Cottonwood Creek	ID16010202BR014_03	At first campsite	8/28/2002 41	—	—	—	—	—
Shingle Creek	ID16010202BR014_03a[b]	At Cottonwood Road/Johnson Road crossing	8/28/2002 550	9/3/2002 1,100	9/9/2002 250	9/12/2002 350	9/16/2002 160	385
Battle Creek	ID16010202BR015_02	Within BURP reach (2006SPOCA016)	9/7/2006 194	—	—	—	—	—
Battle Creek	ID16010202BR015_04	500 m upstream of confluence with Bear River	9/6/2000 390	—	—	—	—	—
Swan Lake Creek	ID16010202BR018_02b[b]	From Cottonwood Road	8/23/2001 1,700	8/28/2001 6,500	9/5/2002 6,100	9/10/2001 8,700	9/13/2001 5,000	4,937
Stockton Creek	ID16010202BR018_03a[a]	At Stockton Road crossing	9/6/2000 4,600	9/11/2000 24,000	9/14/2000 2,500	9/18/2000 1,100	9/21/2000 1,700	3,488
Fivemile Creek	ID16010202BR019_02a[b]	At N 2200 W road crossing	9/6/2000 160	—	—	—	—	—

Assessment Unit Name	Assessment Unit Number	Sample Location	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Geometric mean (cfu/ 100 mL)
Five Mile Creek	ID16010202BR019_02a[b]	At 2200 S. road crossing	8/25/2003 870	8/28/2003 2,400	9/2/2003 690	9/8/2003 730	9/15/2003 370	828
Weston Creek	ID16010202BR020_04	At S 2400 W 3/4 miles south of flume over road	9/6/2000 350	—	—	—	—	—
Weston Creek	ID16010202BR020_04	Just above BURP site (2007SPOCB058)	8/14/2007 387	—	—	—	—	—
Two Mile Canyon	ID16010204BR001_02a	0.5 miles above USFS boundary	6/27/2000 50	—	—	—	—	—
West Cherry Creek	ID16010204BR001_02c	At 2003 BURP site (2003SPOCA008)	8/25/2003 160	—	—	—	—	—
Malad River	ID16010204BR001_04[a]	At Samaria Road	9/1/1999 1,300	9/14/1999 1,100	9/20/1999 11,200	9/22/1999 1,700	9/23/1999 1,500	2,100
Campbell Creek	ID16010204BR002_02a[b]	Above old Highway 191 crossing	6/27/2000 24,000	7/13/2000 8,700	7/18/2000 16,000	7/24/2000 8,200	7/27/2000 4,900	10,606
New Canyon Creek	ID16010204BR002_02b	0.4 miles upstream from USFS boundary	6/27/2000 260	--	--	--	--	--
Devil Creek	ID16010204BR002_03[b]	At west Samaria Lane/ 500 S	9/1/1999 440	9/14/1999 510	9/20/1999 1,600	9/22/1999 3,900	9/23/1999 1,900	1,216
Devil Creek	ID16010204BR002_03[b]	At 1000 N road crossing	8/25/2003 24,000	8/28/2003 2,400	9/2/2003 390	9/8/2003 2,400	9/15/2003 1,700	2,468
First Creek	ID16010204BR006_02a	Above Highway 36 crossing	6/27/2000 350	—	—	—	—	—
First Creek	ID16010204BR006_02a[b]	Below BURP site (2005SPOCA065)	8/15/2005 610	8/19/2005 580	8/22/2005 520	8/25/2005 1,550	8/29/2005 1,550	849
Second Creek	ID16010204BR006_02b	Above Highway 36 crossing	6/27/2000 90	—	—	—	—	—
Deep Creek	ID16010204BR006_03	Just above Deep Creek reservoir	8/23/2001 28	—	—	—	—	—

Assessment Unit Name	Assessment Unit Number	Sample Location	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Collection Date and *E. coli* (cfu/ 100 mL)	Geometric mean (cfu/ 100 mL)
Third Creek	ID16010204BR007_02a	5 m above diversion 42.189548 - 111.131786	6/27/2000 120	—	—	—	—	—
Third Creek	ID16010204BR007_02a[b]	Taken at bottom of BURP reach (2008SPOCA094)	8/5/2008 1733	8/11/2008 517	8/14/2008 345	8/19/2008 921	8/25/2008 DRY	730
Elkhorn Creek	ID16010204BR008_02a	At east Elkhorn Creek Road	8/28/2002 43	—	—	—	—	—
Little Malad River	ID16010204BR008_04[a]	At Highway 38	9/1/1999 1,000	9/14/1999 3,100	9/20/1999 250	9/22/1999 290	9/23/1999 990	740
Indian Mill Creek	ID16010204BR010_02a	1/4 m downstream of 2003 BURP site	8/25/2003 390	—	—	—	—	—
Wright Creek	ID16010204BR010_03[b]	Just above confluence with Dairy Creek	9/1/1999 1,400	9/14/1999 320	9/20/1999 450	9/22/1999 1,200	9/23/1999 510	658
Wright Creek	ID16010204BR010_03[b]	Within BURP reach (2006SPOCA073)	9/7/2006 921	9/11/2006 1,120	9/14/2006 2,419	9/18/2006 756	9/21/2006 2,419	1,355
Wright Creek	ID16010204BR010_03[b]	Within BURP reach (2006SPOCA074)	9/7/2006 1,203	9/11/2006 1,553	9/14/2006 689	9/18/2006 1,120	9/21/2006 2,419	1,284
Wright Creek	ID16010204BR010_04[b]	1/4 mile downstream of 2003 BURP site (2003SPOCA011)	8/25/2003 310	—	—	—	—	—
Dairy Creek	ID16010204BR011_03[b]	100 m above Wright Creek confluence	9/1/1999 2,800	9/14/1999 1,600	9/20/1999 1.150	9/22/1999 6,100	9/23/1999 5,200	2,771

a. *E. coli* data indicate exceedance of water quality standard that is not reflected in the Integrated Report.

b. Assessment unit is on §303(d) list for *E. coli*.

c. Assessment unit has an existing TMDL for *E. coli*.

Notes: *Escherichia coli* (*E. coli)*; colony forming unit (cfu); milliliter (mL); meter (m)

In the Bear Lake subbasin, Pearl Creek (ID16010201BR005_02) had a geometric mean of 837 cfu/100 mL in 2001. Stauffer Creek (ID16010201BR006_03) had a geometric mean of 307 cfu/100 mL in 2000, and Lower Mill Creek (ID16010201BR011_03) had a geometric mean of 212 cfu/100 mL in 2001. These three AUs are not on the §303(d) list or have a TMDL for *E. coli*. They should be resampled to assess their current condition and placed on the current §303(d) list if necessary.

In the Middle Bear subbasin, the lower Cub River (ID16010202BR002_04) had a geometric mean of 473 cfu/100 mL in 2003. Additionally, Strawberry Creek (ID16010202BR007_02a) and Mink Creek (ID16010202BR007_03) exceeded water quality standards for *E. coli* in 2000 with geometric means of 1,070 and 133 cfu/100 mL, respectively. Smith Creek (ID16010202BR009_02a) had a geometric mean of 378 cfu/100 mL in 1999, and Stockton Creek (ID16010202BR018_03a) had a geometric mean of 3,488 cfu/100 mL in 2000. These AUs in the Middle Bear subbasin should be resampled and their support status of recreational beneficial uses should be correctly reflected in the next Integrated Report.

In the Lower Bear/Malad subbasin, both the Malad River (ID16010204BR001_04) and the Little Malad River (ID16010204BR008_04) exceeded water quality standards for *E. coli* in 1999. Geometric means were 2,100 and 740 cfu/100 mL, respectively. These AUs should be resampled to assess their current condition to see if listing and TMDL development are necessary.

3.3.2 Bear River Riverbank Erosive Index

To document current conditions of riverine and riparian habitat in the Bear River, the Pocatello Regional Office conducted a modified version of the streambank erosion inventory (SEI) on 105 miles of the main stem river in 2015. The SEI methodology used on wadeable streams was amended for the main stem river. During an SEI survey on a wadeable stream, technicians walk the banks and record the length and height of eroding and stable banks. As part of this study, a GoPro 3 White Edition camera was mounted to the bow of a canoe and set to take photos at 1-minute intervals. Locations and times of launches and take-outs as well as stops to measure tributary inputs to the Bear River were recorded. Lengths of river surveyed were calculated using ArcMap 10.2.

Each image was examined to determine if it was a usable image (i.e., the canoe was on the river and oriented downstream). Each bank was then examined for the presence of woody riparian vegetation, unstable banks, uncovered banks, and channel stabilization efforts. Channel stabilization efforts include rip-rap, stream barbs, cars, bricks, and channelization to accommodate the railroad. Images were also examined for the presence of Russian olive trees and visible wood in the channel. Russian olive trees were identified as part of an invasive species investigation. In-channel wood was identified because it can enhance channel form, protect banks from erosion, and provide fish habitat.

This study included 105 miles of the Bear River including a portion above Bear Lake (6.1 miles), a portion between Bear Lake and Alexander Reservoir (Nounan Valley, 48.4 miles), a portion between Alexander Reservoir and Oneida Reservoir (Gentile Valley, 19.5 miles), and a portion below Oneida Reservoir (below Oneida, 31.1 miles) (Figure 8). In total, the study generated 1,496 usable images of the Bear River. Percentages of the categories (i.e., images with woody riparian vegetation, unstable banks, uncovered banks, and channel stabilization efforts) were averaged between banks for each survey and weighted means were generated for each category by river section based on the length of river sampled in each survey. Table 9 summarizes the surveys within sections of the Bear River examined by a modified methodology of the SEI during summer 2015.

Above Bear Lake, the Bear River (ID16010201BR002_05) was surveyed near Dingle between Hunter Hill Road and Airport Road below Stewart Dam (Figure 9). In this 6.1-mile section of river, 106 usable images were captured. This section of river was characterized by large, cut banks and mud and gravel bars. Riparian vegetation mainly consisted of cottonwoods and willows. Woody riparian vegetation was present in 97.1% of images, and 43.4% of images contained visible wood in the channel. Unstable banks were present in 41.5% of images, and uncovered banks were present in 36.1%. This section of river contained one of the highest percentages of eroding and uncovered banks in our survey. Channel stabilization efforts were visible in 3.9% of images and included armoring the bank with rock and willow plantings.

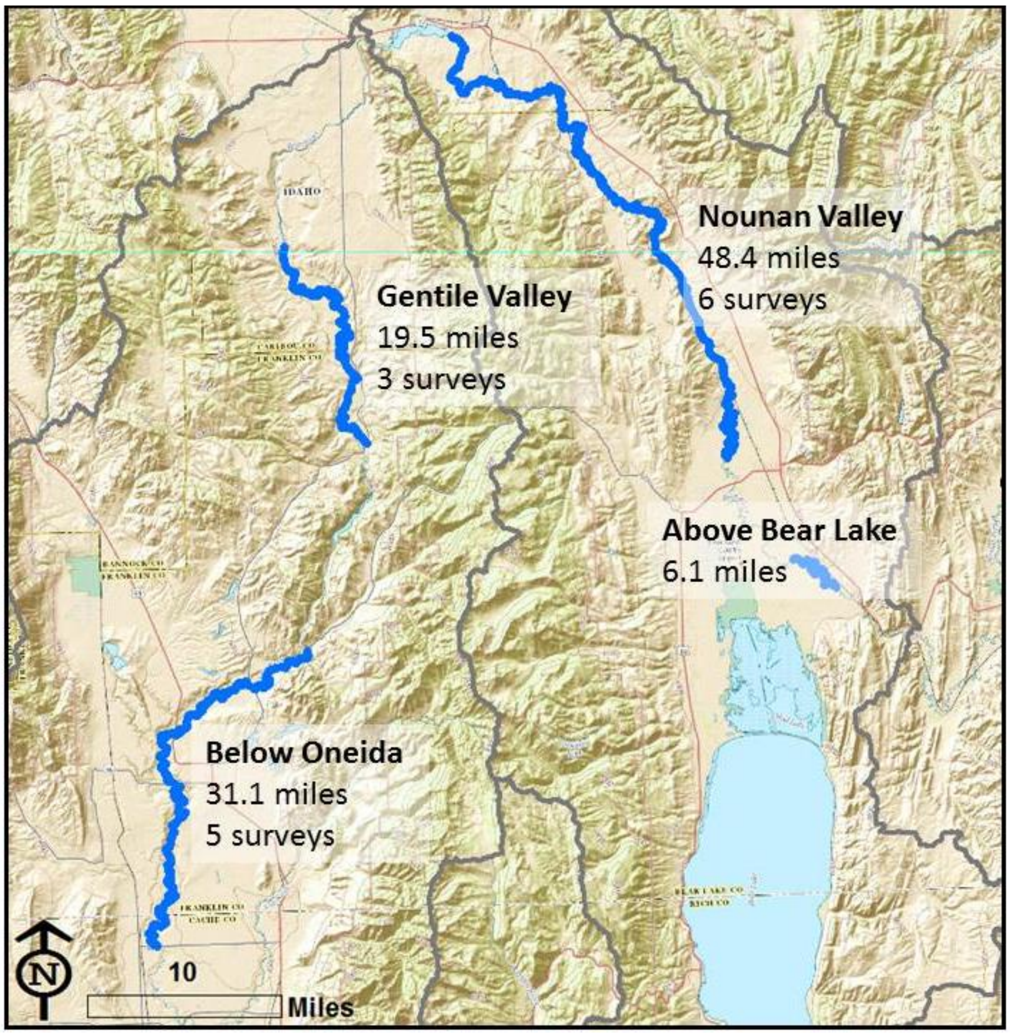


Figure 8. Sections of the Bear River surveyed by canoe with GoPro interval photography during summer 2015.

Figure 9. Representative images of the Bear River (ID16010201BR002_05) in the section sampled above Bear Lake. Note the high cut banks and bars.

Between Bear Lake and Alexander Reservoir, we sampled 48.4 miles of the Bear River (ID16010201BR002_05 and ID16010201BR002_06) with 610 usable images. Overall, this section of the river (Nounan Valley) contained the lowest percentage of unstable and uncovered banks (16.7% and 13.4%, respectively) of the sections sampled (Table 9, Figure 10). However, some surveys, such as Montpelier, contained high percentages (36%) of erosive banks. Overall, 85.7% of images contained woody, riparian vegetation, mainly willows and hawthorns. Channel stabilization efforts were visible in 6.7% of images and were largely a result of rerouting the river to accommodate the railroad that runs through the valley. Wood in the channel was only visible in 2% of images in this river section (Table 9).

Figure 10. Representative images of the Bear River (ID16010201BR002_06) in the Nounan Valley section of the river between Bear Lake and Alexander Reservoir. Note that the river is very wide and banks are protected by willows.

Between Alexander Reservoir and Oneida Reservoir, we sampled 19.5 miles of the Bear River in the Gentile Valley (ID16010202BR009_06a) and captured 349 usable images (Figure 11). This section of the river between River Road (BR14) and Highway 34 (BR15) contained the lowest percentage of images with woody, riparian vegetation (46.7%) of sections sampled. Unstable banks were visible in 36.7% of images, and uncovered banks were visible in 32.8% (Table 9).

This portion of river is characterized by pastures that border the river. Channel stabilization efforts were the most common in this section of river and were visible in 9% of images (Table 9). Channel stabilization efforts were mainly rip-rapped banks and stream barbs made of the same material. In some cases, these efforts seem to be directing erosion to other portions of the bank. Russian olive trees became visible in images within this river section but at relatively low frequency. Overall, Russian olive trees were visible in 8.6% of images within this river reach (Table 9).

Figure 11. Representative images of the Bear River (ID16010202BR009_06a) in the Gentile Valley section. Note the cut bank and lack of woody riparian vegetation in the image at left and the rip-rapped bank in the image at right.

Below Oneida Reservoir, we sampled 31.1 miles of the Bear River (ID16010202BR006_06) with 431 usable images (Figure 12). In this section of the river, Russian olive trees became the dominant riparian vegetation and were visible in 94% of images (Table 9). Mainly because of the presence of Russian olive trees, woody riparian vegetation was present in 97.6% of images within this river section. Overall, unstable banks were present in 19% of images and uncovered banks were present in 17.6% (Table 9). The presence of uncovered and unstable banks, however, was highly variable between surveys within this river section, and bank instability tended to increase downstream. For example, in the most downstream survey between W 3900 S and Highway 61 in Utah, unstable banks were present in 43.5% of images. Wood in the channel was present in 20.4% of images, higher than observed in the Nounan and Gentile Valleys. Channel stabilization efforts were lowest in this section of river and were only observed in 1.2% of images (Table 9).

Figure 12. Representative images of the Bear River (ID16010202BR006_06) in the section below Oneida Reservoir. Note the dominance of Russian olive trees in the riparian zone.

The Gentile Valley contained the most degraded river habitat of the Bear River in Idaho. The section of river was characterized by high levels of unstable and uncovered banks, the lowest percentage of images with woody riparian vegetation, and little in-channel wood, despite the highest percentage of images where channel stabilization efforts were visible (Figure 13 and Figure 14). Channel stabilization efforts in this section of river tend to armor banks with rip rap without addressing the underlying problem of lack of riparian buffer between crops and pasture and the river corridor.

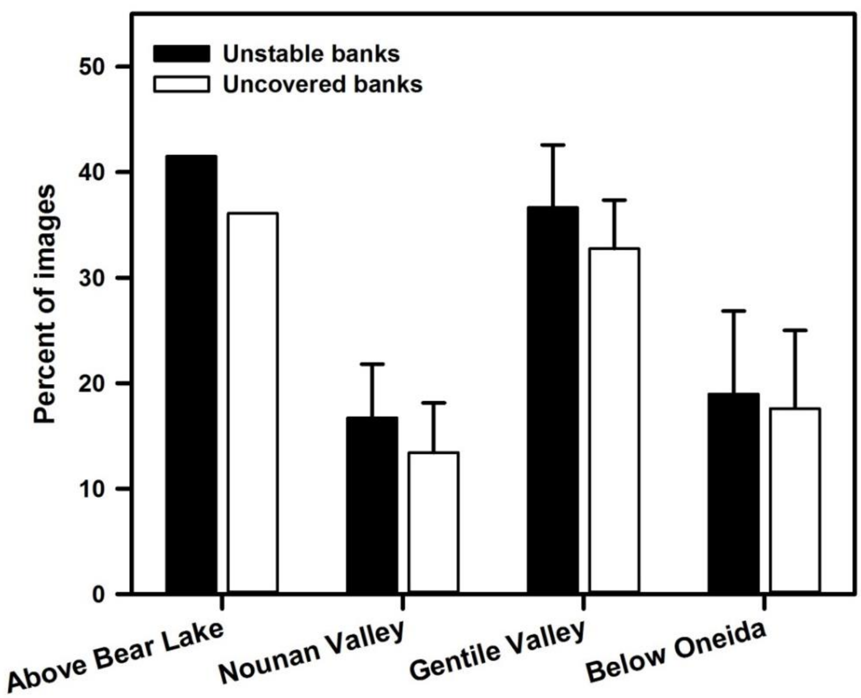


Figure 13. Percent of images within sections of the Bear River (Above Bear Lake n = 1, Nounan Valley n = 6, Gentile Valley n = 3, and Below Oneida n = 4) with unstable (black) and uncovered (white) banks documented during a canoe survey in summer 2015.

Table 9. Summary of surveys within sections of the Bear River examined by a modified methodology of the Streambank Erosion Inventory during summer 2015.

River Section	Survey Title	Put-in Location	Take-out Location	Survey Date	Distance Traveled (miles)	Number of Usable Images	Images with Woody Riparian Vegetation (%)	Images with Unstable Bank (%)	Images with Uncovered Banks (%)	Images with Channel Stabilization Efforts (%)	Images with Russian Olive Trees (%)	Images with Wood in Channel (%)
Above Bear Lake	Dingle	Hunter Hill Rd	Airport Rd/ BR07	7/1/2015	**6.11**	**106**	**97.1**	**41.5**	**36.1**	**3.9**	**0.0**	**43.4**
Nounan Valley	Montpelier	Bern Rd	Pescadero/ BR11	6/24/2015	10.64	132	57.8	36.0	33.3	5.0	1.5	1.5
	Nounan Valley 1	Pescadero/ BR11	Nounan Narrows Bridge	6/25/2015	6.57	102	95.1	6.3	4.9	14.6	0.0	0.0
	Nounan Valley 2	Nounan Narrows Bridge	Unnamed Rd	8/19/2015	13.22	162	90.9	12.6	10.7	7.9	0.0	4.3
	Nounan Valley 3	Unnamed Rd	Eightmile Road Bridge	6/23/2015	7.52	73	89.7	22.1	15.2	3.5	0.0	0.0
	Above Alexander 1	Eightmile Rd Bridge	Bailey Creek Bridge	6/22/2015	5.03	74	97.9	16.0	6.9	7.6	0.0	1.4
	Above Alexander 2	Bailey Creek Bridge	Reservoir Rd/BR12	6/29/2015	5.45	67	93.1	0.7	0.7	0.0	0.0	3.0
			Weighted mean of river section				**85.0**	**17.4**	**14.1**	**6.6**	**0.3**	**2.0**
			Standard errors				6.0	5.1	4.7	2.0	0.3	0.7
Gentile Valley	Gentile Valley 1	River Rd/ BR14	Centennial Bridge	6/10/2015	3.59	72	63.5	22.9	22.2	0.0	0.0	0.0
	Gentile Valley 2	Centennial Bridge	Thatcher Rd. Bridge	6/11/2015	9.23	154	34.8	40.3	36.6	22.9	22.7	0.0
	Gentile Valley 3	Thatcher Rd Bridge	Hwy 34/ BR15	6/15/2015	6.71	123	47.3	41.1	35.3	2.5	1.6	0.0

				Weighted mean of river section			**44.4**	**37.4**	**33.5**	**11.7**	**11.3**	**0.0**
				Standard errors			8.3	5.9	4.6	7.3	7.3	0.0
Below Oneida	Below Oneida	Hwy 36 above Mink Creek	1931 Bridge	7/9/2015	4.64	52	100.0	1.0	1.0	1.9	63.5	25.0
	Above Preston 1	1931 Bridge	Hwy 91	7/10/2015	7.25	96	100.0	4.2	3.7	0.0	96.9	15.6
	Above Preston 2	Hwy 91	Hwy 36	7/8/2015	5.11	67	96.2	11.3	9.1	3.0	100.0	11.9
	Preston	Hwy 36	W 3900 S/ BR17	7/2/2015	7.39	103	99.5	25.8	24.9	0.0	100.0	9.7
	State Line	W 3900 S/ BR17	Hwy 61	7/14/2015	6.69	113	92.4	43.5	40.4	2.2	97.3	40.7
				Weighted mean of river section			**97.6**	**18.5**	**17.1**	**1.3**	**93.2**	**20.4**
				Standard errors			1.5	7.8	7.4	0.6	7.0	5.7

In contrast, the Nounan Valley contained the highest quality river habitat along the Bear River in Idaho. This section of river contained the lowest levels of unstable and uncovered river banks (Figure 13), as well as a high percentage of images with woody riparian vegetation. Invasive Russian olive trees were not observed along this river section. Wood in the channel tended to be quite low, potentially because the dominant riparian vegetation consisted on hawthorns and willows, which may be too small to contribute visible wood. In this river section, channel stabilization efforts primarily focused on protecting the railroad that runs along the river.

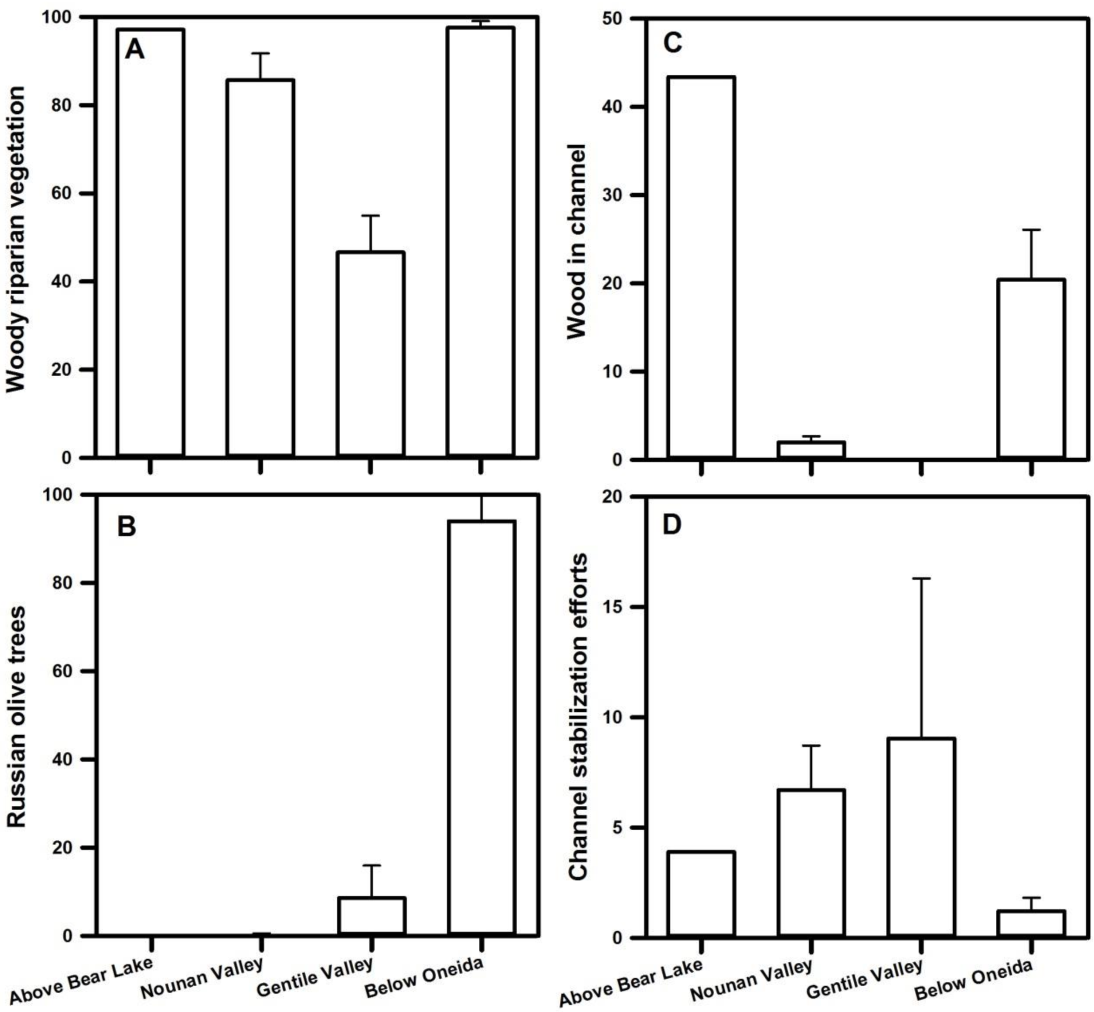


Figure 14. Percent of images within sections of the Bear River where (A) woody riparian vegetation, (B) Russian olive trees, (C) wood in channel, and (D) channel stabilization efforts were visible during a canoe survey in summer 2015.

Figure 15 through Figure 19 show the percentage of images for bank stability, woody riparian vegetation, Russian olive trees, wood in channel, and channel stabilization efforts.

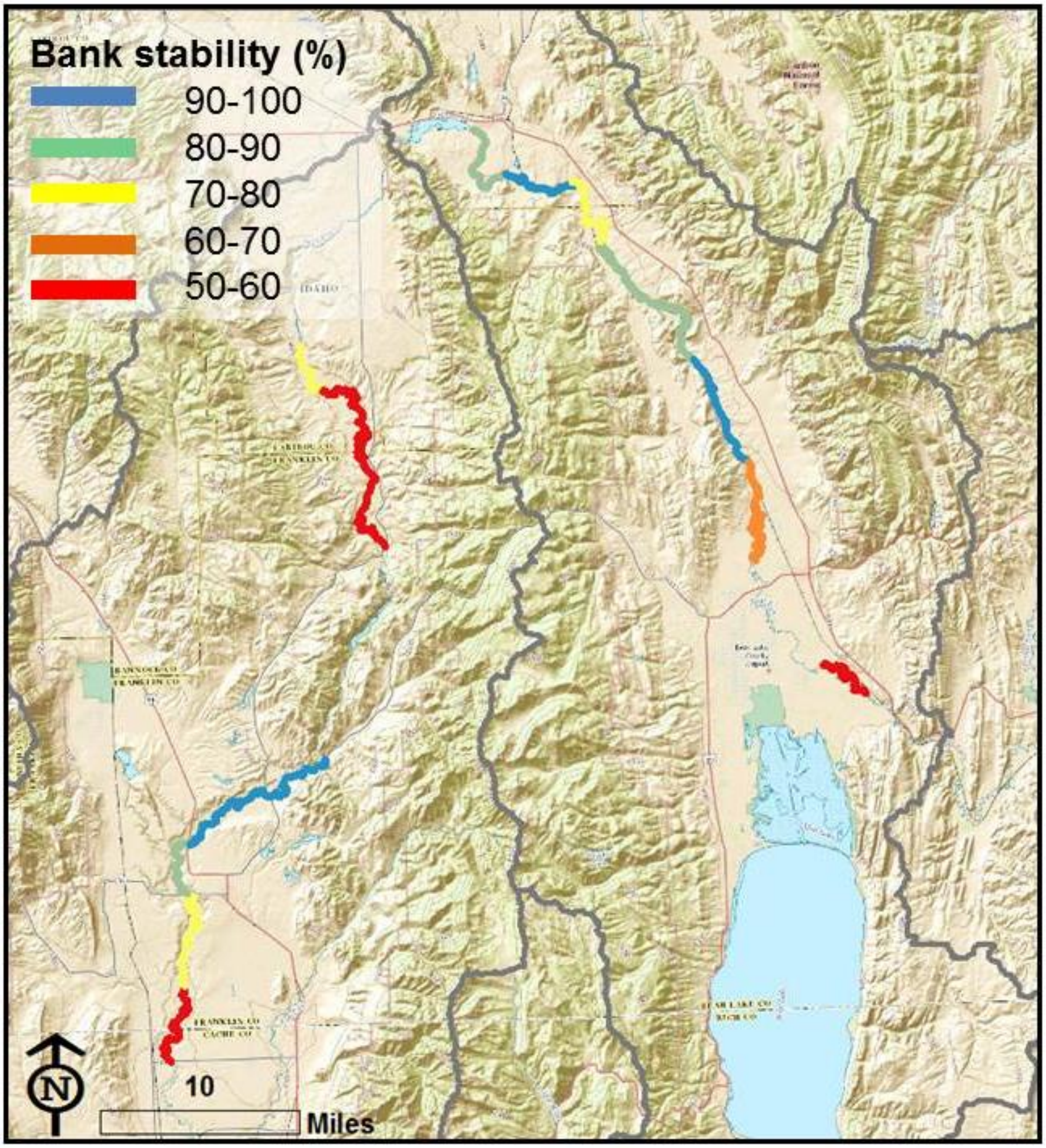


Figure 15. Percentage of images without unstable banks along surveys of the Bear River conducted in 2015.

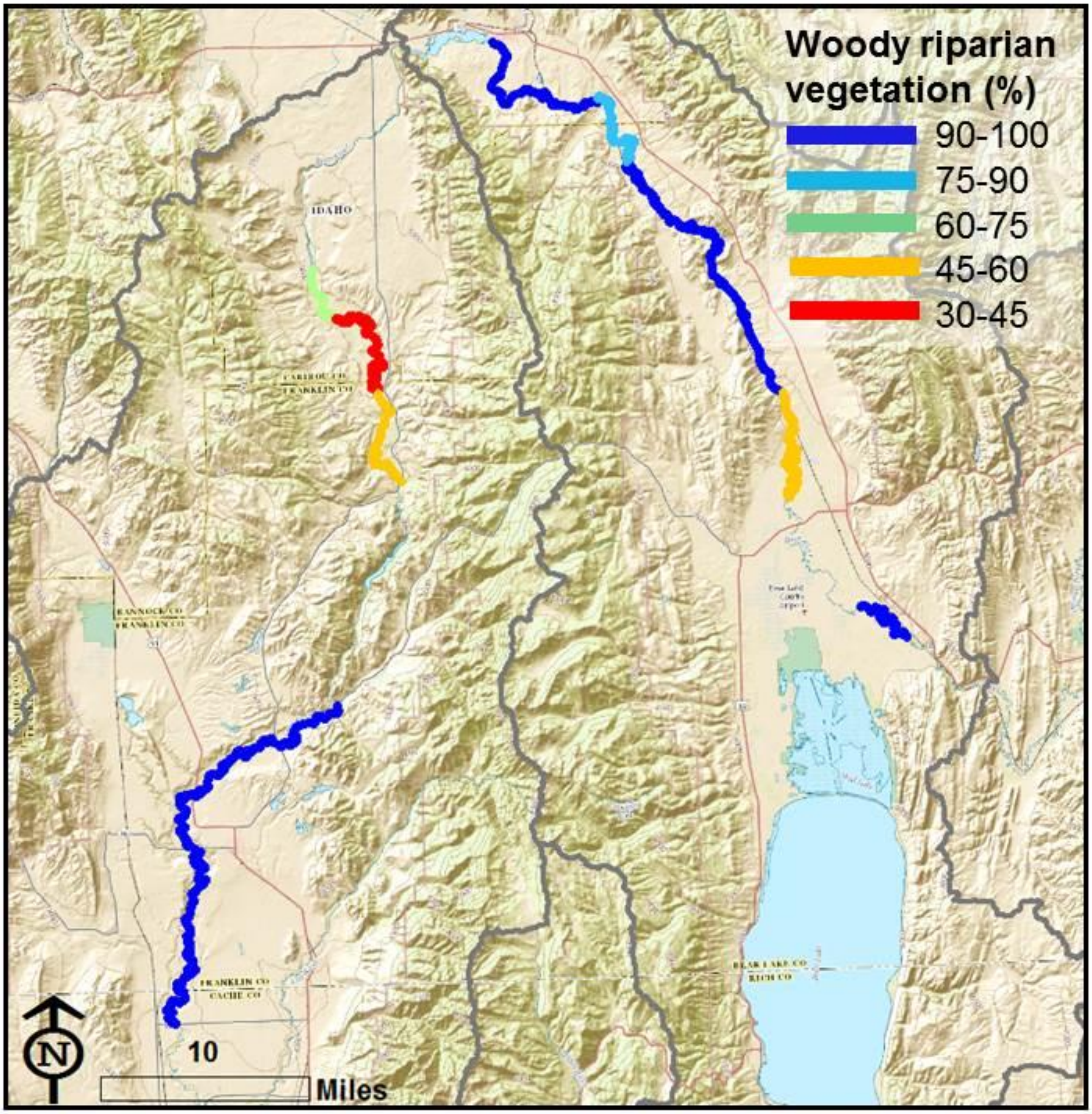


Figure 16. Percentage of images with woody riparian vegetation present along surveys of the Bear River conducted in 2015.

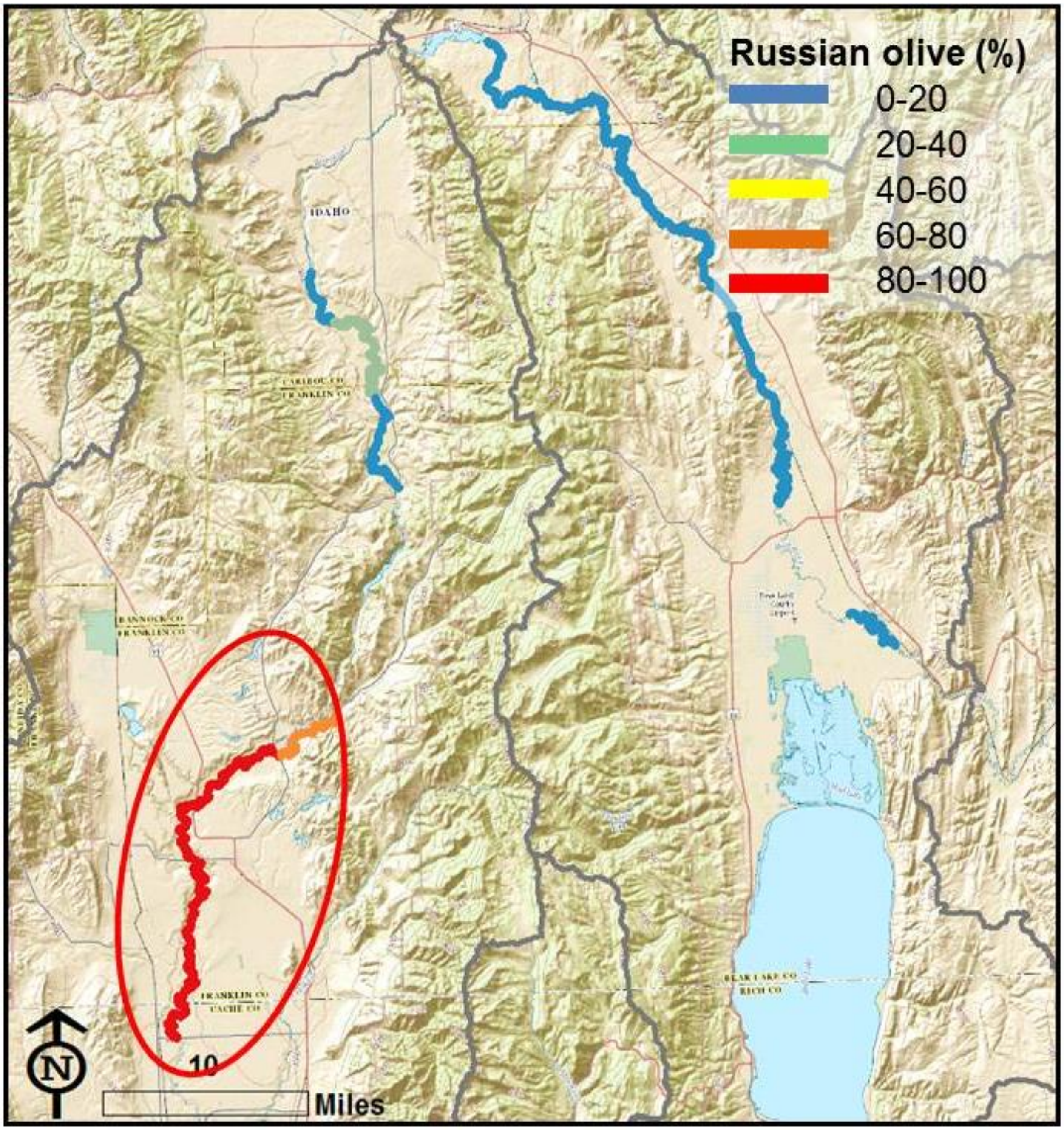


Figure 17. Percentage of images with Russian olive trees visible along surveys of the Bear River in Idaho during summer 2015. The red oval indicates area where Russian olive is the dominant riparian tree.

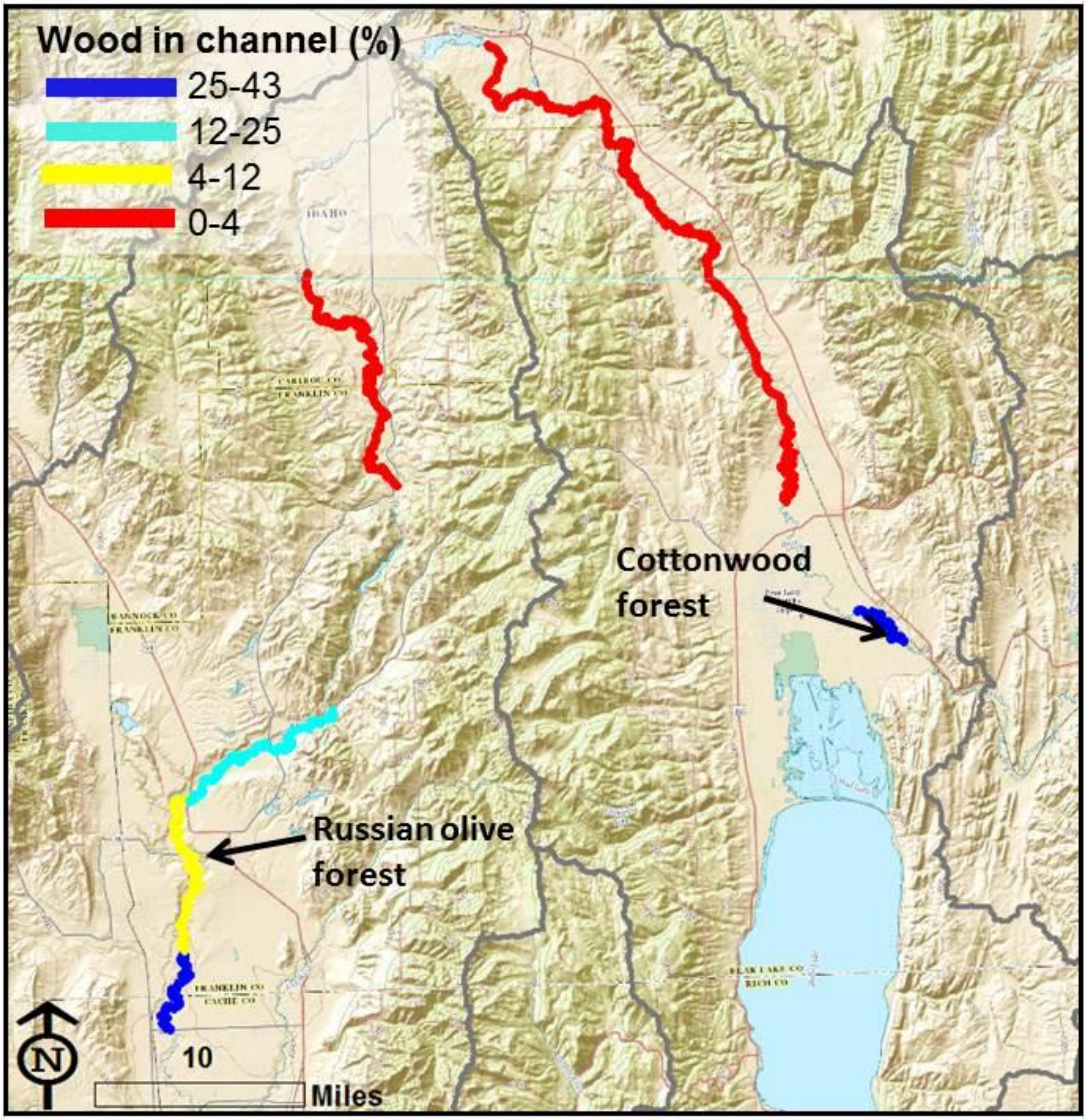


Figure 18. Percentage of images with in-channel wood visible along canoe surveys of the Bear River in Idaho during summer 2015. Arrows indicate the dominant type of in-channel wood observed in surveys.

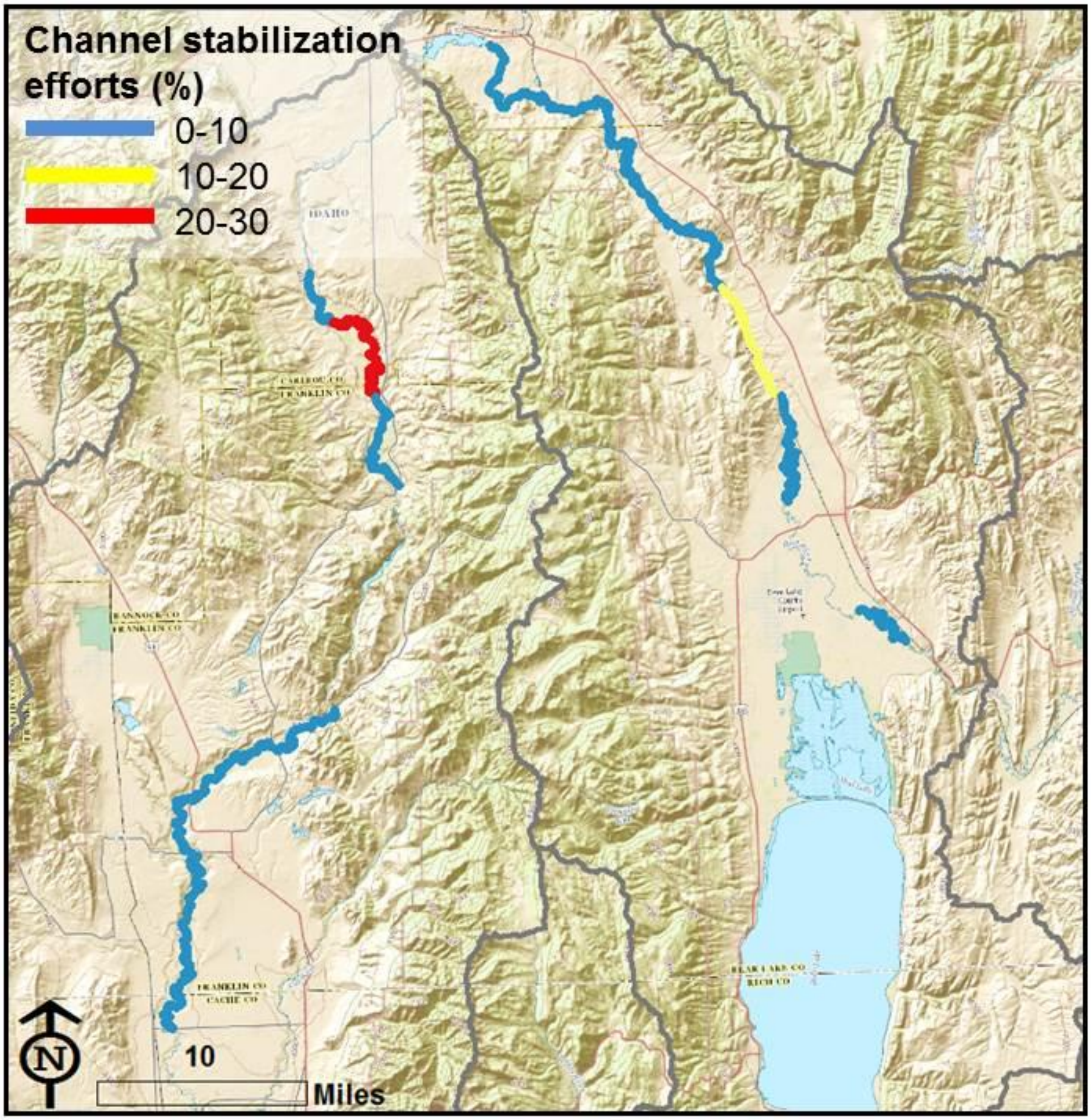


Figure 19. Percentage of images with channel stabilization efforts (i.e., rip rap, stream barbs, and fill) visible along surveys of the Bear River in Idaho in 2015.

3.3.3 Tributary Water Quality Data

Water quality data were collected on tributaries to the Bear and Malad Rivers in 2015. The original data that went into the TMDL approved in 2006 was collected from 1999 to 2000. In 2015, measurements of temperature, specific conductivity, dissolved oxygen, pH, and turbidity were taken with a calibrated YSI multiparameter sonde, and discharge measurements were taken with either a Marsh-McBirney Flowmate or a Teledyne Instruments acoustic Doppler channel profiler. In the Bear River at the Idaho-Wyoming border (BR06, from data collected by DEQ from 2006 to 2015), turbidity measurements are tightly correlated to TSS measurements. The equation TSS (mg/L) = 1.757 (Turbidity (NTUs) – 8.2248 has a correlation coefficient of 0.97.

Further, TSS is strongly correlated with TP concentrations. The equation TP (mg/L) = 0.0015 (TSS (mg/L)) + 0.0192 has a correlation coefficient of 0.97. To generate estimates of TSS and TP loads in Bear River tributaries in 2015, turbidity measurements were applied to these equations and multiplied by measured discharge values. From 1999 to 2000, water samples were collected to represent different hydrologic periods and were analyzed for TSS and TP, and flow was measured. For most cases in 2015, we did not analyze samples for TSS and TP because of budgetary constraints. Rather, we estimated load by taking measured discharge and turbidity values and estimating TP and TSS concentrations using the equations discussed above. In cases where turbidity was below 3.5 NTUs, TSS was estimated to be 0 mg/L, and TP was estimated to be <0.019 mg/L, based on the intercept of the equations.

Central Bear HUC 16010102 Tributaries

Only two tributaries enter the Bear River in the Central Bear subbasin: Thomas Fork and Sheep Creek. In 2015, these tributaries were measured at multiple locations from May to August (Table 10). We sampled the Thomas Fork at four locations along its length in Idaho (Figure 20). There are several 2nd-order tributaries to Sheep Creek. We sampled three that drain into Sheep Creek Reservoir. We also sampled the 3rd-order segment of Sheep Creek below the reservoir at Pegram Road, near its confluence with the Bear River.

Table 10. Description and location of tributary monitoring locations in the Central Bear subbasin.

Water Body	Assessment Unit Number	Location Description	Coordinates (decimal degrees)
Thomas Fork	ID16010102BR003_04	At Carricaburu Road	42.39589 -111.04781
Thomas Fork	ID16010102BR003_04	At Highway 89	42.35898 -111.05382
Thomas Fork	ID16010102BR003_04	At Skyline Road Bridge	42.25609 -111.08199
Thomas Fork	ID16010102BR003_04	At Highway 30	42.21349 -111.06977
Sheep Creek	ID16010102BR008_02	Sheep Creek	42.24883 -111.13687
Sheep Creek	ID16010102BR008_02	West Fork	42.25407 -111.14072
Sheep Creek	ID16010102BR008_02	Spring Creek	42.24496 -111.13797
Sheep Creek	ID16010102BR008_03	At Pegram Road	42.19918 -111.15746

Observed temperatures in the Thomas Fork ranged from 7.33 ˚C at Carricaburu Road on May 20 to 20.35 ˚C at Highway 30 on August 13. Temperatures tended to increase as the river progressed downstream on all four sample dates. No temperature exceedances of water quality standards were documented during the 2015 sampling effort. Like temperature, conductivity increased in the downstream direction and ranged from 0.675 to 1.003 ms/cm^2. All dissolved oxygen values were in excess of 8 mg/L. Stream discharge was elevated in May and June and subsided in July and August (Table 11). On May 20, turbidity was highest in upstream sites at Carricaburu Road and at Highway 89 but declined at Skyline Road Bridge and Highway 30. High turbidities at these sites correlated with likely exceedances of TMDL targets for TSS and TP, but by the time the river reached its confluence with the Bear River at Highway 30, sediment loads had declined to below target levels. At Highway 30, Thomas Fork was sampled, and laboratory results indicate that TMDL targets for TP, TSS, and TIN were being met on May 20, 2015 (Table 12).

In the 1999–2000 sampling effort, average TP concentration in Thomas Fork was 0.078 mg/L, with values ranging from 0.025 to 0.201 mg/L. In 2015, the average estimated TP concentration at all sites was 0.054 mg/L with values ranging from 0.019 to 0.165 mg/L. On average, Thomas Fork was contributing approximately 470.3 kilograms per day (kg/day) TSS and 10.7 kg/day TP to the Bear River.

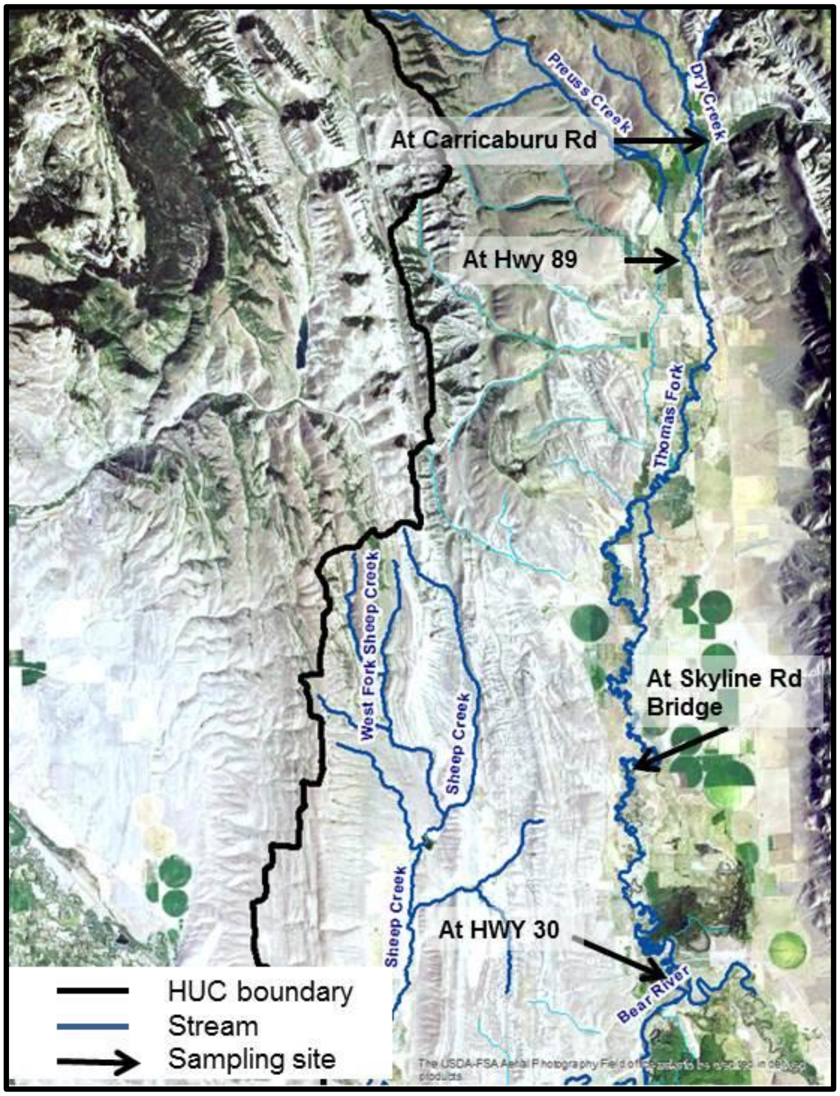


Figure 20. Location of Thomas Fork sampling locations.

Table 11. Measured discharge and turbidity and estimated TSS and TP concentrations and loads in the Thomas Fork (ID16010102BR003_04) at various locations in 2015.

Location	Date	Discharge (cfs)	Turbidity (NTUs)	Estimated TSS (mg/L)	Estimated TP (mg/L)	Estimated TSS load (kg/day)	Estimated TP load (kg/day)
At Carricaburu Road	5/20/2015	152.2	54.3	87[a]	0.150[a]	32,482.8	55.9
	6/8/2015	149.8	19.0	25	0.057	9,239.7	20.9
	7/16/2015	47.7	6.8	4	0.025	440.6	2.9
	8/13/2015	32.9	6.3	3	0.023	228.9	1.9
	Mean	95.7	21.6	30	0.064	6,965.7	14.9
	Standard deviation	64.2	22.6	40	0.060	6233.0	9.3
At Highway 89	5/20/2015	142.8	59.8	97[a]	0.165[a]	3,3852.8	57.5
	6/8/2015	131.1	22.6	31	0.066	10,098.2	21.3
	7/16/2015	34.7	8.1	6	0.028	505.5	2.4
	8/13/2015	19.8	4.4	0	<0.019	0.0	<0.9
	Mean	82.1	23.7	34	0.070	6,744.7	14.0
	Standard deviation	63.8	25.3	44	0.067	6,927.0	10.4
At Skyline Road Bridge	5/20/2015	115.8	15.5	19	0.048	5,370.5	13.5
	6/8/2015	189.1	25.3	36	0.073	16,736.1	34.0
	7/16/2015	32.4	4.3	0	<0.019	0.0	<1.5
	8/13/2015	32.4	10.1	10	0.034	758.9	2.7
	Mean	92.4	13.8	16	0.043	3,657.8	9.8
	Standard deviation	75.5	8.9	15	0.023	2,847.3	4.3
At Highway 30	5/20/2015	149.7	10.5	10	0.034	3,725.1	12.6
	6/8/2015	207.7	13.8	16	0.043	8,114.7	21.9
	7/16/2015	52.2	12.5	14	0.040	1,747.7	5.1
	8/13/2015	39.7	12.0	13	0.039	1,254.1	3.7
	Mean	112.3	12.2	13	0.039	3,623.2	10.7
	Standard deviation	80.4	1.4	2	0.004	470.3	0.7

a. TP or TSS targets were likely exceeded.

Table 12. Laboratory results from Thomas Fork Creek.

Water Body	Location	Date	Ammonia (mg/L)	TKN (mg/L)	N + N (mg/L)	TIN (mg/L)	TP	TSS
Thomas Fork	At Hwy 90	5/20/2015	0.059	0.7	0.28	0.339	0.049	14

The 2nd-order tributaries to Sheep Creek Reservoir varied substantially in water quality measures (Figure 21). Spring Creek comes to the surface within 200 meters of the reservoir and tends to be clear, cold, and well oxygenated. Temperatures in Spring Creek ranged from 10.27 to 11.29 ˚C, and turbidity was 0 on all three visits. In contrast, Sheep Creek and West Fork warmed considerably as the summer progressed and temperatures on August 13 exceeded water quality standards for cold water aquatic life with observed temperatures of 22.63 and 26.56 ˚C, respectively. Turbidity in these creeks also tended to be high and likely correlated with exceedances of TSS and TP target concentrations (Table 13). High turbidity was likely the result of grazing cattle in or near the stream. The 3rd-order segment of Sheep Creek was visited on four occasions in 2015 but was only flowing on May 20. This creek likely went dry as flows were not released from Sheep Creek Reservoir, and the stream flows through a cow pasture before it reaches the Bear River.

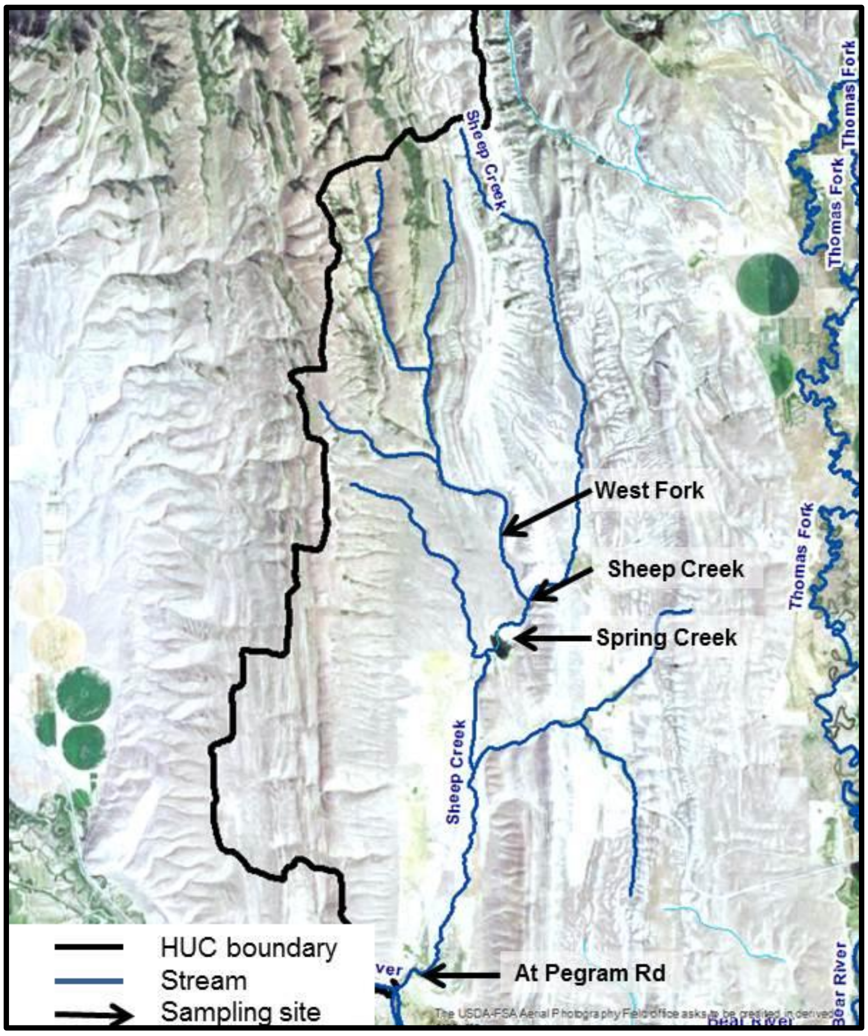


Figure 21. Location of Sheep Creek sampling locations.

Table 13. Measured discharge and turbidity and estimated TSS and TP concentrations and loads in Sheep Creek (ID16010102BR008_02 and ID16010102BR008_03) at various locations in 2015.

Location	Date	Discharge (cfs)	Turbidity (NTUs)	Estimated TSS (mg/L)	Estimated TP (mg/L)	Estimated TSS load (g/day)	Estimated TP load (g/day)
Sheep Creek	6/9/2015	0.52	12.5	14	0.040	17,477.3	50.6
	7/16/2015	0.40	34.0	52	0.096[a]	50,412.3	94.4
	8/13/2015	0.39	84.5	140[a]	0.230[a]	133,813.4	219.0
West Fork	6/9/2015	0.25	52.4	84[a]	0.145[a]	51,281.4	88.7
	7/16/2015	0.34	44.1	69[a]	0.123[a]	57,611.9	102.4
	8/13/2015	0.21	169.0	289[a]	0.452[a]	148,332.5	232.4
Spring Creek	6/9/2015	0.18	0	0	<0.019	—	<8.5
	7/16/2015	0.22	0	0	<0.019	—	<10.3
	8/13/2015	0.09	0	0	<0.019	—	<4.2
At Pegram Road	5/20/2015	0.04	8.8	7	0.030	708.2	2.9
	6/9/2015	Dry	—	—	—	—	—
	7/16/2015	Dry	—	—	—	—	—
	8/13/2015	Dry	—	—	—	—	—

a. TP or TSS targets were likely exceeded.

Bear Lake HUC 16010201 Tributaries

Ovid, Georgetown, Stauffer, Skinner, Pearl, Eightmile, Sulphur Canyon, Bailey, and Soda Creeks enter the Bear River in the Bear Lake HUC. Table 14 displays the coordinates and descriptions of tributary sampling locations used during the 2015 study. BURP scores indicated that some upper reaches of streams with TMDLs may be supporting cold water aquatic life and meeting TMDL targets. We sampled a subset of AUs for TP and TSS on May 21, 2015, to document directly if TMDL targets were being achieved. Sampling results are provided in Table 16.

Table 14. Description and location of tributary monitoring locations in the Bear Lake subbasin.

Water Body	Assessment Unit Number	Location	Coordinates (decimal degrees)
Ovid Creek	ID16010201BR009_04	At Cutler Road	42.30337 -111.37366
Ovid Creek	ID16010201BR009_04	At Bern Road	42.32859 -111.36817
Right-Hand Fork Georgetown Creek	ID16010201BR022_02a	At USFS Road 225	42.49409 -111.31300
Georgetown Creek	ID16010201BR022_02b	Above USFS boundary	42.49576 -111.30601
Lower Georgetown Creek	ID16010201BR022_03a	At Highway 30	42.47846 -111.37155
Upper Stauffer Creek[a]	ID16010201BR006_02c	Above USFS boundary	42.42248 -111.47905
Lower Stauffer Creek	ID16010201BR006_03	At Narrows Road	42.47725 -111.40971
Upper Skinner Creek[a]	ID16010201BR007_02a	At USFS Road 403	42.46847 -111.50386
Lower Skinner Creek[a]	ID16010201BR002_02c	At Nounan Road	42.47944 -111.45110
Lower Pearl Creek	ID16010201BR005_02	At Nounan Road	42.52929 -111.47613
Upper Eightmile Creek[a]	ID16010201BR004_02	Above USFS boundary	42.51036 -111.51036
North Wilson Creek	ID16010201BR004_02a	Above Eightmile Canyon Road	42.53813 -111.57505
Eightmile Creek[a]	ID16010201BR004_03	At Eightmile Road	42.59581 -111.52036
Sulphur Canyon Creek	ID16010201BR002_02a	At Eightmile Road	42.60945 -111.52490
Upper Bailey Creek[a]	ID16010201BR003_02a	Above USFS boundary	42.57159 -111.58737
Lower Bailey Creek	ID16010201BR003_02	At Bailey Creek Road	42.60529 -111.57511
Upper Soda Creek	ID16010201BR025_02	At Government Dam Road	42.70670 -111.61199
Middle Soda Creek	ID16010201BR023_02a	At E 1st Street N	42.66080 -111.60213
Lower Soda Creek	ID16010201BR023_02b	Below Highway 34	42.65484 -111.61863

a. Site was sampled for TSS and TP on 5/21/2015.

Table 15. Measured discharge and turbidity and estimated TSS and TP concentrations and loads in tributaries to the Bear River in the Bear Lake HUC.

Water Body	Location	Date	Discharge (cfs)	Turbidity (NTUs)	TSS (mg/L)	TP (mg/L)	TSS load (kg/day)	TP load (kg/day)
Ovid Creek	At Cutler Road	5/20/2015	—	0.0	0	<0.019	—	—
		6/9/2015	—	0.0	0	<0.019	—	—
		6/24/2015	—	0.0	0	<0.019	—	—
		8/5/2015	—	0.0	0	<0.019	—	—
		Mean	—	0.0	0	<0.019	—	—
		St deviation	—	0.0	0	0.000	—	—
Ovid Creek	At Bern Road	6/24/2015	—	1.7	0	<0.019	—	—
		8/5/2015	—	4.6	0	<0.019	—	—
		Mean	—	3.2	0	<0.019	—	—
		St deviation	—	2.1	0	0.000	—	—
Right-Hand Fork Georgetown Creek	At USFS Road 225	5/20/2015	0.59	4.8	0	0.020	0.3	0.03
		6/8/2015	1.27	7.2	4	0.026	13.8	0.08
		6/25/2015	1.71	6.5	3	0.024	13.4	0.10
		8/5/2015	2.18	3.2	0	<0.019	0.0	<0.10
		Mean	1.44	5.4	2	0.022	6.9	0.08
		St deviation	0.68	1.8	2	0.003	3.6	0.01
Georgetown Creek	Above USFS boundary	5/20/2015	48.65	3.2	0	<0.019	0.0	<2.29
		6/8/2015	49.50	1.1	0	<0.019	0.0	<2.33
		6/25/2015	43.34	1.0	0	<0.019	0.0	<2.04
		8/5/2015	34.79	0.0	0	<0.019	0.0	<1.63
		Mean	44.07	1.3	0	<0.019	0.0	<2.07
		St deviation	6.76	1.4	0	0.000	0.0	0.00
Lower Georgetown Creek	At Highway 30	5/20/2015	48.41	5.7	2	0.022	212.0	2.59
		6/8/2015	52.81	2.9	0	<0.019	0.0	<2.48
		6/25/2015	31.09	2.8	0	<0.019	0.0	<1.46
		8/5/2015	15.93	2.9	0	<0.019	0.0	<0.75
		Mean	37.06	3.6	0	0.020	40.6	1.80
		St deviation	16.92	1.4	1	0.001	37.1	0.06
Upper Stauffer Creek	Above USFS boundary	5/18/2015	15.08	8.8	7	0.030	267.0	1.11
		5/21/2015	22.99	11.1	11	0.036	634.3	2.03
		6/8/2015	14.32	11.6	12	0.037	425.9	1.31
		8/5/2015	1.64	1.0	0	<0.019	0.0	<0.08
		Mean	13.51	8.1	8	0.031	253.4	1.01
		St deviation	8.83	4.9	6	0.008	119.7	0.18

Water Body	Location	Date	Discharge (cfs)	Turbidity (NTUs)	TSS (mg/L)	TP (mg/L)	TSS load (kg/day)	TP load (kg/day)
Lower Stauffer Creek	At Narrows Road	7/28/2015	4.47	5.8	2	0.022	21.5	0.24
		8/19/2015	—	9.7	9	0.032	—	—
		Mean	—	7.8	5	0.027	—	—
		St deviation	—	2.8	5	0.007	—	—
Upper Skinner Creek	At USFS Road 403	5/18/2015	9.61	11.2	11	0.036	269.3	0.86
		5/21/2015	12.99	10.7	11	0.035	336.1	1.11
		6/8/2015	12.55	6.5	3	0.024	98.1	0.74
		7/28/2015	1.95	2.3	0	<0.019	0.0	<0.09
		Mean	9.28	7.7	6	0.029	143.1	0.65
		St deviation	5.11	4.2	6	0.008	70.0	0.11
Lower Skinner Creek	At Nounan Road	5/18/2015	3.70	12.9	14	0.041	130.7	0.37
		5/21/2015	7.26	11.7	12	0.038	219.0	0.67
		6/8/2015	6.95	5.6	2	0.022	27.5	0.37
		7/28/2015	Dry	—	—	—	—	—
		Mean	5.97	10.1	9	0.033	138.2	0.47
		St deviation	1.97	3.9	7	0.010	33.2	0.17
Lower Pearl Creek	At Nounan Road	5/18/2015	9.25	17.7	23	0.053	516.5	1.21
		6/8/2015	9.95	11.3	12	0.037	283.1	0.89
		7/28/2015	1.92	6.7	4	0.025	16.7	0.12
		Mean	7.04	11.9	13	0.038	218.2	0.66
		St deviation	4.45	5.5	10	0.015	105.3	0.16
Upper Eightmile Creek	Above USFS boundary	5/18/2015	27.48	4.6	0	0.019	0.0	1.29
		5/21/2015	35.92	5.9	2	0.022	192.8	1.98
		6/4/2015	40.68	6.5	3	0.024	323.3	2.40
		6/23/2015	16.36	2.4	0	<0.019	0.0	<0.77
		7/28/2015	6.10	2.1	0	<0.019	0.0	<0.29
		Mean	25.31	4.3	1	0.021	67.4	1.29
		St deviation	14.17	2.0	2	0.002	53.2	0.08
North Wilson Creek	Above Eightmile Canyon Road	5/18/2015	0.14	7.5	5	0.027	1.7	0.01
		6/4/2015	0.17	5.5	1	0.021	0.6	0.01
		6/23/2015	0.11	10.1	10	0.033	2.6	0.01
		7/28/2015	0.16	3.6	0	<0.019	0.0	<0.01
		Mean	0.15	6.7	4	0.025	1.4	0.01
		St deviation	0.03	2.8	4	0.006	0.3	0.00
Eightmile Creek	At Eightmile Road	5/18/2015	36.52	9.3	8	0.031	720.4	2.80
		5/20/2015	45.94	13.0	15	0.041	1,636.9	4.61
		6/4/2015	57.92	13.0	15	0.041	2,063.7	5.82
		6/23/2015	22.26	9.0	8	0.031	416.1	1.67

Water Body	Location	Date	Discharge (cfs)	Turbidity (NTUs)	TSS (mg/L)	TP (mg/L)	TSS load (kg/day)	TP load (kg/day)
		7/28/2015	8.70	1.7	0	<0.019	0.0	<0.41
		Mean	34.27	9.2	9	0.033	751.7	2.74
		St deviation	19.36	4.6	6	0.009	285.7	0.43
Sulphur Canyon Creek	At Eightmile Road	6/4/2015	0.50	0.0	0	<0.019	0.0	<0.02
		6/9/2015	0.20	0.0	0	<0.019	0.0	<0.01
		6/22/2015	dry	—	—	—	—	—
		7/28/2015	dry	—	—	—	—	—
		Mean	0.35	0.0	0	<0.019	0.0	<0.02
		St deviation	0.21	0.0	0	0.000	0.0	0.00
Upper Bailey Creek	Above USFS boundary	5/18/2015	4.11	3.2	0	<0.019	0.0	<0.19
		5/21/2015	4.16	10.9	11	0.036	111.2	0.36
		6/4/2015	3.78	4.5	0	<0.019	0.0	<0.18
		6/22/2015	3.15	2.5	0	<0.019	0.0	<0.15
		7/28/2015	3.36	1.6	0	<0.019	0.0	<0.16
		Mean	3.71	4.5	2	0.022	19.8	0.20
		St deviation	0.45	3.7	5	0.007	5.4	0.01
Lower Bailey Creek	At Bailey Creek Road	5/18/2015	2.28	5.8	2	0.022	11.0	0.12
		6/4/2015	3.23	6.4	3	0.024	23.9	0.19
		6/22/2015	1.37	3.9	0	<0.019	0.0	<0.06
		7/28/2015	1.49	2.3	0	<0.019	0.0	<0.07
		Mean	2.09	4.6	1	0.021	6.4	0.11
		St deviation	0.86	1.9	2	0.002	3.2	0.00
Upper Soda Creek	At Government Dam Road	6/4/2015	33.04	15.4	19	0.047	1522.4	3.84
		7/28/2015	33.85	7.6	5	0.027	424.7	2.23
		Mean	33.45	11.5	12	0.037	980.3	3.04
		St deviation	0.57	5.5	10	0.015	13.6	0.02
Middle Soda Creek	At E 1st Street N	6/4/2015	31.13	1.5	0	<0.019	0.0	<1.46
		7/28/2015	37.58	3.2	0	<0.019	0.0	<1.77
		Mean	34.36	2.4	0	<0.019	0.0	<1.61
		St deviation	4.56	1.2	0	0.000	0.0	0.00
Lower Soda Creek	Below Highway 34	4/20/2015	17.69	7.3	5	0.026	199.1	1.13
		6/4/2015	20.94	1.4	0	<0.019	0.0	<0.98
		7/28/2015	3.81	4.0	0	<0.019	0.0	<0.18
		Mean	14.15	4.2	2	0.022	53.1	0.74
		St deviation	9.10	3.0	3	0.004	59.1	0.09

Table 16. Laboratory results for AUs in the Bear Lake subbasin.

Water Body	Location	Date	TP (mg/L)	TSS (mg/L)
Upper Stauffer Creek	At USFS boundary	5/21/2015	0.029	5
Upper Skinner Creek	At USFS Road 403	5/21/2015	0.036	<5
Lower Skinner Creek	At Nounan Road	5/21/2015	0.041	9
Upper Eightmile Creek	Above USFS boundary	5/21/2015	0.020	5
Lower Eightmile Creek	At Eightmile Road	5/21/2015	0.026	10
Upper Bailey Creek	Above USFS boundary	5/21/2015	0.026	12

Ovid Creek—Ovid Creek (ID16010201BR009_04) was measured at two locations in 2015, at Cutler Road and at Bern Road. Because this water body is regulated and diverted for irrigation, it was not possible to measure discharge. In both monitoring locations, water did not appear to be flowing but was typically clear, with turbidity values below 5. Water temperatures ranged from 15.4 ˚C on May 20 to 23.18 ˚C on June 24 at Bern Road. Dissolved oxygen was below water quality standards (6 mg/L) on June 24 in both locations and was only 2.87 mg/L on August 5 at Cutler Road. Dissolved oxygen deficits were likely due to hydrologic modification.

Georgetown Creek—Georgetown Creek was monitored at three locations in 2015, upper, right-hand fork, and lower. Georgetown Creek was typically clear, cold, and well oxygenated. Turbidity values never exceeded 8 NTUs during sampling. The water body appears to be meeting TMDL targets for TSS and TP.

Stauffer Creek—Stauffer Creek was measured at two locations in 2015, above the USFS boundary and at Nounan Narrows Road right before its confluence with the Bear River. Above the USFS boundary, TSS was 5 mg/L and TP was 0.029 mg/L on May 21, 2015. These measurements indicate that TMDL targets are being met. Lower Stauffer Creek is diverted for agriculture, and flow was so low on August 19 that a discharge measurement was not possible. Water was generally clear, and no exceedances of TMDL targets were observed.

Skinner Creek—Skinner Creek was measured in two locations in 2015, on USFS land and at Nounan Road. Water clarity was high, and no exceedances of TMDL targets or water quality standards were observed in 2015. Upper Skinner Creek had a measured TSS of <5 mg/L and TP of 0.036 mg/L on May 21, 2015, indicating that TMDL targets are being met. Skinner Creek always had reduced flow compared to Upper Skinner Creek because of irrigation diversions. On May 21, 2015 TSS was 9 mg/L, and TP was 0.041 mg/L. On July 28, 2015, Lower Skinner Creek at Nounan Rd was dewatered entirely.

Eightmile Creek—Eightmile Creek was monitored at three locations in 2015, above the USFS boundary, North Wilson Creek, a tributary, and Lower Eightmile Creek at Eightmile Road. Water quality was consistently good, with Eightmile Creek delivering relatively clear and cold water to the Bear River. Unlike other tributaries, it appeared that Eightmile Creek was connected to the river throughout the summer. TP and TSS were measured at Upper and Lower Eightmile Creek on May 21, 2015. TSS was 5 mg/L and 10 mg/L at the upper and lower sites, respectively. TP was 0.020 mg/L and 0.026 mg/L. Both measurements indicate that TMDL targets are being met.

Sulphur Canyon—Sulphur Canyon (ID16010201BR002_02a) enters the Bear River below Eightmile Creek and was monitored at Eightmile Road. This tributary originates from Sulphur

Springs and has low flows. Sulphur Canyon Creek had turbidity values of 0 on both June 4 and June 9 but had no flowing water on June 22 and July 28.

Bailey Creek—Bailey Creek was monitored at two locations in 2015, above the USFS boundary and at Bailey Creek Road. At Bailey Creek Road, flows were always below flows observed above the USFS boundary due to irrigation diversions. Water quality was good on all occasions, and no exceedances of TMDL targets or water quality standards were observed. Upper Bailey Creek had a TSS concentration of 12 mg/L and a TP concentration of 0.026 mg/L on May 21, 2015, indicating that TMDL targets are being met.

Soda Creek—Soda Creek enters Alexander Reservoir near Soda Springs and was monitored at three locations in 2015. Upper Soda Creek was monitored at Government Dam Road before it flows into Soda Creek Reservoir. Middle Soda Creek, below the reservoir, was monitored at East 1st Street North in Soda Springs, and Lower Soda Creek was monitored below Highway 34. The highest turbidity observed was 15.4 at Upper Soda Creek on June 3, and turbidities at all three locations tended to be quite low. Soda Creek has been monitored by DEQ on six occasions since 2008. Analytical results are displayed in Table 17. TP exceeds TMDL targets during all sampling events. In Soda Creek, the relationship between suspended sediment concentration (SSC) and TP is different than observed in the Bear River at the Idaho-Wyoming border. The regression line (Figure 22) is an order of magnitude steeper than in the river, and the intercept is 0.06 for Soda Creek compared to 0.02 for the Bear River at the Idaho-Wyoming border.

Loads of TP in Soda Creek exceeded the 2006 TMDL target of 12.6 lb/day on all occasions it was sampled when the stream was not diverted for agriculture. During July 2014, flows were reduced due to diversions, and TP concentration was significantly lower than at other times.

Table 17. Water quality parameters of Lower Soda Creek (ID16010201BR023_02b) below Highway 34.

Date	Discharge (cfs)	Turbidity (NTUs)	NH4 (mg/L)	NO3+NO2 (mg/L)	TKN (mg/L)	Orthophosphate (mg/L)	TP (mg/L)	SSC (mg/L)	TP load (lb/day)
10/6/2008	26.9	13.9	0.062	1.10	0.66	0.088	0.43[b]	25	62.5
11/20/2008	36.4	8.5	0.180	1.30	0.52	0.047	0.22[b]	12	43.2
1/13/2009	41.4	10.6	0.170	1.30	0.55	0.043	0.26[b]	11	62.6
4/23/2009	15[a]	12.4	<0.010	0.81	0.43	0.043	0.33[b]	14	26.7[a]
7/30/2014	1.28	3.1	0.035	0.18	0.32	0.009	0.058[b]	<5	0.4
4/20/2015	17.7	7.3	0.017	0.84	0.12	0.041	0.19[b]	6.5	18.1

a. Flow was estimated and not measured on this date. TP load is an estimate.
b. Exceedance of TMDL targets.

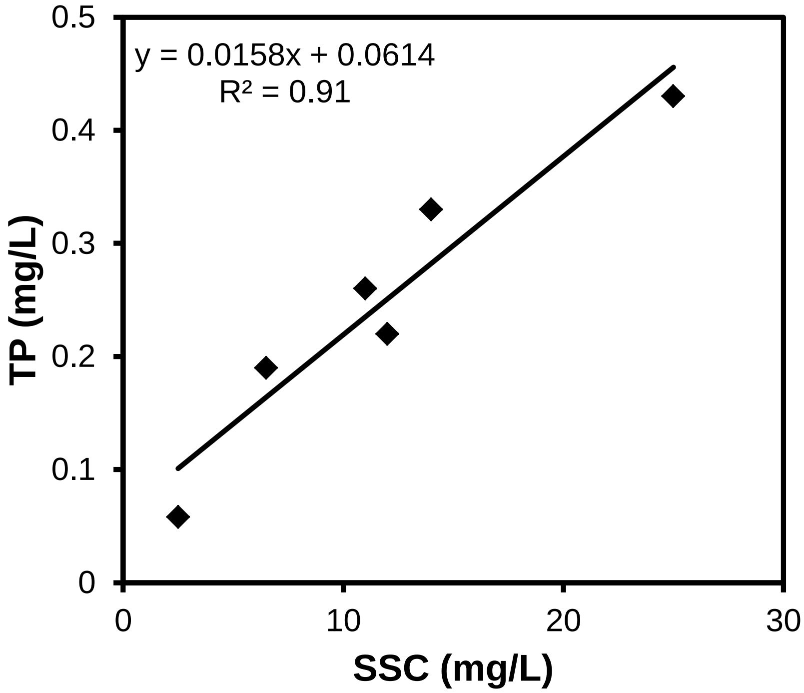


Figure 22. Relationship between SSC and TP in Lower Soda Creek (ID16010201BR023_02b).

P4's (a subsidiary of Monsanto) elemental phosphorus plant pumps ground water for production purposes and then discharges noncontact cooling water, boiler blowdown, and stormwater via a pipeline to Soda Creek after it is routed through a wastewater treatment pond (EPA 2013, Figure 23). P4 has an National Pollution Elimination Discharge System (NPDES) permit to control thermal load to Soda Creek (EPA 2003). The permit expired in 1987 but has been administratively extended. This permit does not limit phosphorus or other water constituents. When the P4 facility was inspected by EPA in 2013, TP in the effluent was 0.885 mg/L. The TMDL target in Soda Creek is 0.05 mg/L as Soda Creek enters Alexander Reservoir. Excluding stormwater events, P4 discharges approximately 4.68 cfs resulting in 22.4 lb/day of phosphorus being contributed to Soda Creek (EPA 2013). Future permits should limit phosphorus discharges as water quality monitoring documents exceedances of TMDL targets.

Figure 23. P4's discharge to Soda Creek (EPA 2013).

Middle Bear HUC 16010202 Tributaries

Smith, Alder, Whiskey, Burton, Trout, Williams, Cottonwood, Mink, Battle, Deep, Fivemile, and Weston Creeks enter the Bear River in the Middle Bear subbasin. The Cub River (including Maple Creek, which confluences above Franklin City in Idaho) enters the Bear River in Utah but originates in and flows through Idaho. Worm Creek originates and flows mostly through Idaho and confluences with the Cub River in Utah. Table 18 displays the tributary monitoring locations for the 2015 study, and Table 19 displays monitoring results.

Maple Creek received a TMDL for *E. coli* in the 2006 document, so samples were collected in 2015 to document current bacteria levels. A five-sample geometric mean was also collected from Alder and Fivemile Creeks during the 2015 sampling effort because these AUs are on the §303(d) list for *E. coli*. Monitoring results are displayed in Table 20.

Table 18. Description and location of tributary monitoring locations in the Middle Bear subbasin.

Water Body	Assessment Unit Number	Location	Coordinates (decimal degrees)
Dry Creek	ID16010202BR009_02a	At River Road	42.47960 -111.79468
Smith Creek	ID16010202BR009_02a	At River Road	42.47605 -111.79429
Alder Creek	ID16010202BR009_02b	At Thatcher Cemetery Road	42.45272 -111.77509
Alder Creek[a]	ID16010202BR009_02b	At River Road	42.45969 -111.77319
Whiskey Creek	ID16010202BR012_02	At N Lago Road	42.44884 -111.72401
Burton Creek	ID16010202BR009_02c	At Thatcher Cemetery Road	42.43922 -111.77525
Burton Creek	ID16010202BR009_02c	At River Road	42.43532 -111.75607
Trout Creek	ID16010202BR011_02	At Steele Lane	42.43706 -111.70133
Trout Creek	ID16010202BR011_03	At Highway 34	42.35813 -111.71321
Williams Creek	ID16010202BR010_02a	At Highway 34	42.35813 -111.71321
Cottonwood Creek	ID16010202BR014_04	At Highway 34	42.33570 -111.73221
Birch Creek	ID16010202BR007_02	At Capitol Hill Road	42.19370 -111.77637
Mink Creek	ID16010202BR007_03	At E Riverdale Road	42.79370 -111.77637
Battle Creek	ID16010202BR015_02	At Treaureton Cemetery Road	42.27458 -111.84619
Battle Creek	ID16010202BR015_03	At 9000 N	42.26337 -111.84131
Battle Creek	ID16010202BR015_04	At Hot Springs Road	42.14378 -111.91356
Deep Creek	ID16010202BR006_02a	At 1500 N	42.12094 -111.93089
Fivemile Creek	ID16010202BR019_02	Off Fivemile Road	42.11381 -112.02052
Fivemile Creek[a]	ID16010202BR019_02a	At 2200 W	42.10018 -111.93023
Black Canyon	ID16010202BR020_02a	Off Clarkston Road	42.01677 -112.02776
Weston Creek	ID16010202BR020_03	At 5600 W	42.03638 -112.01242
Crooked Creek	ID16010202BR003_02	On Maple Creek Road	42.04305 -111.73627
Upper Maple Creek[a]	ID16010202BR003_02a	Above USFS boundary	42.06778 -111.70715
Lower Maple Creek[a]	ID16010202BR003_03a	At 3400 E	42.02874 -111.79206
Cub River	ID16010202BR003_03	At 3200 E	42.03275 -111.79827
Cub River	ID16010202BR002_04	At 4800 S bridge	42.01351 -111.81766
Worm Creek	ID16010202BR005_02b	At 4800 S	42.01375 -111.85726

a. *E. coli* monitoring was conducted at this location.

Table 19. Measured discharge and turbidity and estimated TSS and TP concentrations and loads in tributaries to the Bear River in the Middle Bear HUC.

Water Body	Location	Date	Discharge (cfs)	Turbidity (NTUs)	TSS (mg/L)	TP (mg/L)	TSS load (kg/day)	TP load (kg/day)
Dry Creek	At River Road	4/2/2015	0.97	42.2	66	0.118[a]	156.4	0.28
		5/28/2015	0.50	45.4	72	0.127[a]	87.5	0.15
		6/10/2015	0.97	62.1	101[a]	0.171[a]	239.4	0.40
		8/5/2015	0.37	6.3	3	0.023	2.6	0.02
		Mean	0.70	39.0	60	0.110[a]	121.5	0.22
		St deviation	0.31	23.5	41	0.062	100.7	0.16
Smith Creek	At River Road	4/2/2015	2.77	11.3	12	0.037	78.8	0.25

Water Body	Location	Date	Discharge (cfs)	Turbidity (NTUs)	TSS (mg/L)	TP (mg/L)	TSS load (kg/day)	TP load (kg/day)
		5/28/2015	4.98	46.6	74	0.130[a]	897.4	1.58
		6/10/2015	2.81	25.2	36	0.073	247.8	0.50
		8/5/2015	2.77	15.0	18	0.046	122.9	0.31
		Mean	3.33	24.5	35	0.071	336.7	0.66
		St deviation	1.10	15.8	28	0.042	380.6	0.62
Alder Creek	At Thatcher Cemetery Road	4/2/2015	1.84	41.7	65	0.117[a]	292.8	0.53
		5/28/2015	5.44	65.1	106[a]	0.178[a]	1412.9	2.37
		6/10/2015	1.43	28.1	41	0.081[a]	144.0	0.28
		8/5/2015	0.19	15.6	19	0.048	8.9	0.02
		Mean	2.23	37.6	58	0.106[a]	464.6	0.80
		St deviation	2.26	21.2	37	0.056	642.7	1.07
Alder Creek	At River Road	5/28/2015	8.99	69.2	113[a]	0.189[a]	2493.3	4.16
		6/10/2015	0.13	15.0	18	0.046	5.8	0.01
		8/3/2015	0.18	1.4	0	<0.019	0.0	<0.01
		8/6/2015	0.11	1.1	0	<0.019	0.0	<0.01
		8/11/2015	0.03	2.1	0	<0.019	0.0	<0.00
		8/14/2015	0.00	1.9	0	<0.019	0.0	<0.00
		8/18/2015	0.69	2.2	0	<0.019	0.0	<0.03
		Mean	1.45	13.3	19	0.047	357.0	0.60
		St deviation	3.33	25.2	42	0.063	942.0	1.57
Whiskey Creek	At N Lago Road	6/4/2015	30.00	0.0	0	<0.019	0.0	<1.41
		8/5/2015	—	0.0	0	<0.019	—	—
		Mean	30.00	0.0	0	<0.019	0.0	<1.41
		St deviation	—	0.0	0	0.000	—	—
Burton Creek	At Thatcher Cemetery Road	4/2/2015	0.91	24.0	34	0.070	75.6	0.16
		5/28/2015	2.85	62.8	102[a]	0.172[a]	712.0	1.20
		8/5/2015	0.63	12.6	14	0.040	21.4	0.06
		Mean	1.46	33.1	50	0.094[a]	269.7	0.47
		St deviation	1.21	26.3	46	0.069	384.0	0.63
Burton Creek	At River Road	5/28/2015	2.56	61.5	100[a]	0.169[a]	625.3	1.06
		8/5/2015	0.80	6.0	2	0.023	4.5	0.04
		Mean	1.68	33.8	51	0.096[a]	314.9	0.55
		St deviation	1.24	39.2	69	0.103	438.9	0.72
Trout Creek	At Steele Lane	4/2/2015	3.39	20.4	28	0.061	229.1	0.50
		6/3/2015	8.69	6.0	2	0.023	49.3	0.48
		8/5/2015	1.48	12.5	14	0.040	49.7	0.14
		Mean	4.52	13.0	15	0.041	109.4	0.38
		St deviation	3.74	7.2	13	0.019	103.7	0.20
Trout Creek	At Highway 34	4/2/2015	9.29	12.7	14	0.040	320.2	0.92
		6/3/2015	51.60	7.7	5	0.027	669.6	3.43
		8/5/2015	20.15	37.4	57	0.105[a]	2834.0	5.20
		Mean	27.01	19.3	26	0.058	1274.6	3.18

Water Body	Location	Date	Discharge (cfs)	Turbidity (NTUs)	TSS (mg/L)	TP (mg/L)	TSS load (kg/day)	TP load (kg/day)
		St deviation	21.97	15.9	28	0.042	1361.7	2.15
Williams Creek	At Highway 34	4/2/2015	18.77	5.6	2	0.022	74.1	0.99
		6/3/2015	38.77	4.0	0	<0.019	0.0	<1.82
		8/5/2015	4.98	0.3	0	<0.019	0.0	<0.23
		Mean	20.84	3.3	1	0.020	24.7	1.02
		St deviation	16.99	2.7	1	0.001	42.8	0.79
Cottonwood Creek	At Highway 34	4/2/2015	25.46	6.1	2	0.023	155.3	1.43
		5/28/2015	89.94	27.1	39	0.078[a]	8667.5	17.23
		7/20/2015	Dry	—	—	—	—	—
		Mean	57.70	16.6	21	0.051	4411.4	9.33
		St deviation	45.59	14.8	26	0.039	6019.1	11.17
Birch Creek	At Capitol Hill Road	4/16/2015	5.89	5.1	1	0.020	10.6	0.29
		5/28/2015	23.85	18.8	25	0.056	1447.5	3.29
		7/9/2015	0.81	0.1	0	<0.019	0.0	<0.04
		8/21/2015	0.00	0.0	0	<0.019	0.0	<0.00
		Mean	7.64	6.0	6	0.029	364.5	0.91
		St deviation	11.12	8.9	12	0.018	722.0	1.60
Mink Creek	At E Riverdale Road	4/16/2015	3.83	6.9	4	0.025	36.5	0.23
		5/28/2015	—	15.8	20	0.049	—	—
		5/28/2015	—	600.7	1047[a]	1.590[a]	—	—
		6/3/2015	241.40	7.7	5	0.027	3132.6	16.04
		7/9/2015	3.88	0.1	0	<0.019	0.0	<0.18
		8/21/2015	4.31	0.0	0	<0.019	0.0	<0.20
		Mean	50.68	105.2	179[a]	0.288[a]	633.8	3.33
		St deviation	106.63	242.8	425	0.638	1397.0	7.10
Battle Creek	At Treasureton Cemetery Road	4/16/2015	2.39	20.1	27	0.060	158.4	0.35
		5/28/2015	1.69	58.6	95[a]	0.161[a]	391.7	0.67
		7/20/2015	0.34	12.3	13	0.039	11.1	0.03
		8/21/2015	0.22	12.1	13	0.039	7.0	0.02
		Mean	1.16	25.8	37	0.075[a]	142.1	0.27
		St deviation	1.06	22.2	39	0.059	180.7	0.31
Battle Creek	At 9000 N	4/16/2015	7.19	28.7	42	0.083[a]	742.4	1.45
		5/28/2015	3.61	61.6	100[a]	0.169[a]	883.3	1.49
		7/20/2015	0.55	45.4	72[a]	0.127[a]	96.3	0.17
		8/21/2015	0.69	16.4	21	0.050	34.8	0.08
		Mean	3.01	38.0	59	0.107[a]	439.2	0.80
		St deviation	3.12	19.7	35	0.052	436.0	0.78
Battle Creek	At Hot Springs Road	7/8/2015	1.44	83.5	138[a]	0.227[a]	487.9	0.80
		8/21/2015	1.13	28.5	42	0.082[a]	115.7	0.23
		Mean	1.29	56.0	90[a]	0.154[a]	301.8	0.51

Water Body	Location	Date	Discharge (cfs)	Turbidity (NTUs)	TSS (mg/L)	TP (mg/L)	TSS load (kg/day)	TP load (kg/day)
		St deviation	0.22	38.9	68	0.102	263.2	0.41
Deep Creek	At 1500 N	5/28/2015	72.02	108.5	182[a]	0.293[a]	32141.0	51.59
		7/8/2015	20.13	21.6	30	0.064	1464.0	3.14
		8/21/2015	9.03	8.9	7	0.030	163.8	0.67
		Mean	33.73	46.3	73[a]	0.129[a]	11256.2	18.47
		St deviation	33.62	54.2	95	0.143	18098.4	28.71
Fivemile Creek	Off Fivemile Road	5/28/2015	0.63	390.0	677[a]	1.035[a]	1043.5	1.59
Fivemile Creek	At 2200 W	3/12/2015	2.64	13.1	15	0.041	95.5	0.27
		5/28/2015	3.58	15.1	18	0.047	160.3	0.41
		7/8/2015	1.87	1.7	0	<0.019	0.0	<0.09
		8/3/2015	2.96	3.4	0	<0.019	0.0	<0.14
		8/6/2015	2.33	2.7	0	<0.019	0.0	<0.11
		8/11/2015	2.41	2.6	0	<0.019	0.0	<0.11
		8/14/2015	1.68	4.4	0	<0.019	0.0	<0.08
		8/18/2015	1.46	4.6	0	<0.019	0.0	<0.07
		Mean	2.37	6.0	4	0.025	32.0	0.16
		St deviation	0.70	5.1	8	0.012	61.7	0.12
Black Canyon	Off Clarkston Road	5/28/2015	1.02	183.2	314[a]	0.490[a]	782.7	1.22
		7/14/2015	0.23	40.2	62[a]	0.113[a]	35.1	0.06
		8/28/2015	0.15	93.0	155[a]	0.252[a]	56.9	0.09
		Mean	0.47	105.5	177[a]	0.285[a]	291.6	0.46
		St deviation	0.48	72.3	127[a]	0.191[a]	425.5	0.66
Weston Creek	At 5600 W	4/29/2015	0.19	18.8	25	0.056	11.5	0.03
		5/28/2015	0.56	92.1	154[a]	0.250[a]	210.4	0.34
		7/14/2015	0.79	2.4	0	<0.019	0.0	<0.04
		8/28/2015	0.52	1.9	0	<0.019	0.0	<0.02
		Mean	0.52	28.8	45	0.090[a]	55.5	0.11
		St deviation	0.25	42.92	74	0.110	103.4	0.16
Crooked Creek	On Maple Creek Road	4/29/2015	6.78	7.8	5	0.027	90.9	0.45
		6/3/2015	9.89	5.7	2	0.022	43.3	0.53
		7/20/2015	Dry	—	—	—	—	—
		8/3/2015	Dry	—	—	—	—	—
		Mean	8.34	6.8	4	0.025	67.1	0.49
		St deviation	2.20	1.5	3	0.004	33.6	0.05
Upper Maple Creek	Above USFS boundary	4/29/2015	19.55	4.7	0	<0.019	1.6	<0.92
		6/3/2015	25.01	1.9	0	<0.019	0.0	<1.17
		7/20/2015	4.33	0.1	0	<0.019	0.0	<0.20
		8/3/2015	2.75	0.1	0	<0.019	0.0	<0.13
		8/6/2015	2.45	0.0	0	<0.019	0.0	<0.12
		8/11/2015	1.72	0.0	0	<0.019	0.0	<0.08

Water Body	Location	Date	Discharge (cfs)	Turbidity (NTUs)	TSS (mg/L)	TP (mg/L)	TSS load (kg/day)	TP load (kg/day)
		8/14/2015	1.53	0.0	0	<0.019	0.0	<0.07
		8/18/2015	1.44	0.0	0	<0.019	0.0	<0.07
		Mean	7.35	0.9	0	<0.019	0.2	<0.35
		St deviation	9.38	1.7	0	0.000	0.6	0.44
Lower Maple Creek	At 3400 E	7/20/2015	2.17	3.0	0	<0.019	0.0	<0.10
		8/3/2015	0.58	5.8	2	0.022	2.8	0.03
		8/6/2015	0.89	0.5	0	<0.019	0.0	<0.04
		8/11/2015	0.73	5.4	1	0.021	2.3	0.04
		8/14/2015	0.29	2.2	0	<0.019	0.0	<0.01
		8/18/2015	0.56	0.9	0	<0.019	0.0	<0.03
		Mean	0.87	3.0	1	0.020	0.8	0.04
		St deviation	0.67	2.2	1	0.001	1.3	0.03
Cub River	At 3200 E	4/29/2015	—	14.0	16	0.044	—	—
		6/3/2015	339.90	14.6	17	0.045	14492.4	37.71
		7/20/2015	12.85	3.8	0	<0.019	0.0	<0.60
		8/21/2015	3.38	0.0	0	<0.019	0.0	<0.16
		Mean	118.71	8.1	8	0.03	4830.82	12.82
		St deviation	191.61	7.3	10	0.01	8367.22	21.55
Cub River	At 4800 S bridge	4/16/2015	20.05	3.1	0	<0.019	0.0	<0.94
		6/3/2015	388.90	18.2	24	0.055	22599.9	52.17
		7/20/2015	14.00	8.1	6	0.028	205.7	0.97
		8/21/2015	2.53	7.4	5	0.026	29.6	0.16
		Mean	106.37	9.2	9	0.032	5708.8	13.56
		St deviation	188.49	6.4	10	0.016	11261.1	25.74
Worm Creek	At 4800 S	4/16/2015	4.72	52.3	84[a]	0.145[a]	966.2	1.67
		6/3/2015	22.79	23.6	33	0.069	1853.4	3.85
		7/20/2015	1.20	30.0	44	0.086[a]	130.6	0.25
		8/21/2015	0.43	10.0	9	0.033	9.8	0.03
		Mean	7.29	29.0	43	0.083[a]	740.0	1.45
		St deviation	10.50	17.6	31	0.047	855.4	1.76

a. TP or TSS targets were likely exceeded.

Table 20. *E. coli* data for AUs sampled in 2015 in the Middle Bear subbasin (HUC 16010202).

Water Body	Location	Date	*E. coli* (cfu/100 mL)
Alder Creek	At River Road	8/3/2015	173
		8/6/2015	291
		8/11/2015	194
		8/14/2015	1,986
		8/18/2015	2,828
		Geometric mean	560
Fivemile Creek	At 2200 W	8/3/2015	260
		8/6/2015	201
		8/11/2015	192
		8/14/2015	345
		8/18/2015	727
		Geometric mean	302
Upper Maple Creek	Above USFS boundary	8/3/2015	128
		8/6/2015	7
		8/11/2015	2
		8/14/2015	6
		8/18/2015	1
		Geometric mean	6
Lower Maple Creek	At S 3400 E	8/3/2015	1,986
		8/6/2015	1,300
		8/11/2015	1,414
		8/14/2015	1,120
		8/18/2015	866
		Geometric mean	1,288

Dry and Smith Creeks—The results in Table 19 indicate that many of the tributaries that enter the Bear River on the western side of the river in the Gentile Valley likely exceeded TMDL targets in 2015. Dry and Smith Creeks belong to the same AU but differ in water quality measures. Dry Creek was cloudy with average turbidity of 39 NTUs. Smith Creek tended to be clearer, with average turbidity of 24.5 NTUs. Smith Creek was warmer than Dry Creek. Water temperatures exceeded water quality standards in Smith Creek on June 3 and August 5. The water was 25.7 ˚C on August 5. We did not document exceedances of temperature criteria in Dry Creek. Exceedances of water quality standards for temperature may be the result of a warm water springs entering the creek.

Alder and Burton Creeks—Both Alder and Burton Creeks drain into a ditch, and the water below the ditch is a result of the overflow of the combined water. We measured both creeks, above the ditch at Thatcher Cemetery Road and below the ditch at River Road. For both streams, conductivity tended to be higher below the ditch than above. Both creeks are impacted by cattle operations. Alder Creek runs through a pasture with severely trampled banks between Thatcher Cemetery Road and River Road. Burton Creek also flows through a cattle pasture above River Road, and its banks are uncovered below River Road (Figure 24).

Alder Creek was also sampled for *E. coli* concentrations at River Road. Bacteria concentrations were over 4 times higher in Alder Creek than Idaho's water quality standard of a geometric mean of 126 cfu/100 mL for five samples collected within 3 to 7 days of each other (Table 20). High bacteria levels in Alder Creek likely reflect unrestricted livestock access to this waterway.

Figure 24. Alder Creek (ID16010202BR009_02b) and Burton Creeks (ID16010202BR009_02c) from River Road.

Spring-fed tributaries in the Gentile Valley (Whiskey, Williams, and Trout Creeks)— Above Oneida Reservoir, tributaries that enter the river on its eastern side differ from tributaries that enter on the western side. Eastern tributaries (Whiskey, Trout, and Williams) are spring fed and tend to have lower turbidities than Dry, Smith, Alder, and Burton Creeks (Table 19). During all sampling events, Whiskey and Williams Creeks had low turbidities (< 6 NTUs), and no exceedances of temperature standards were observed. Both the 2nd- and 3rd-order segments of Trout Creek were sampled. Both segments had low turbidity values that correlated with meeting TMDL targets, except for the 3rd-order segment on August 5, 2015. During this time turbidity was 37.4 NTUs at Highway 34, correlating with exceedances of TP targets (Table 19). High turbidity was likely the result of cattle observed in the creek upstream.

Cottonwood Creek—Cottonwood Creek is a major tributary to Oneida Reservoir. The creek was sampled in April and May, but by July, it was completely dewatered at Highway 34. When the creek was running, we did not document any exceedances of water quality standards or TMDL targets (Table 19).

Mink and Birch Creek—Below Oneida Reservoir, Mink Creek enters the Bear River as the river valley opens up after Oneida Narrows. Birch Creek is a tributary to Mink Creek that was monitored as part of this study. Birch Creek was clear and cold at Capitol Hill Road, and we did not document any exceedances of TMDL targets or water quality standards. Mink Creek also tended to be clear and cold. This stream is diverted for agriculture and experiences times of low flow. In 2015, the creek always reached the river. On May 28, a cloudy burst with thunder and hail caused rapid erosion of the slopes adjacent to the hillslope and temporarily elevated turbidity to levels that exceeded TMDL targets (601 NTUs, Table 19). This event illustrated that the majority of exported sediment and phosphorus can occur over short time periods and be triggered by weather events. Figure 25 shows Mink Creek at 3:00 and 3:30 p.m. before and after the storm.

High turbidity inputs from Mink Creek were clearly visible in the Bear River below the Highway 36 crossing (Figure 26).

Figure 25. Mink Creek (ID16010202BR007_03) at East Riverdale Road before and after a localized cloud burst on May 28, 2015.

Figure 26. Mink Creek entering the Bear River below Highway 36 bridge on May 28, 2015.

Battle Creek—Battle Creek enters the Bear River above Preston right below the Highway 91 Bridge. The 2nd- and 3rd-order segments of Battle Creek were measured above Treasureton Reservoir, and the 4th-order segment of Battle Creek was measured near its confluence with the Bear River at Hot Springs Road. At all monitoring points, Battle Creek had high turbidity values that likely correlated with exceedances of TMDL targets (Table 19). No exceedances of temperature standards were observed above Treasureton Reservoir. Near the confluence with the

Bear, however, Battle Creek was 26.6 ˚C on July 8. High turbidities in Battle Creek are likely the result of farming and grazing practices (Figure 27).

Figure 27. Battle Creek (ID16010202BR015_03) above Treasureton Reservoir at 9000 N.

Deep Creek—Deep Creek enters the Bear River below Hot Springs Road near Preston. This tributary has high sediment and phosphorus loads and likely exceeded TMDL targets on May 28 (Table 19). High turbidities in Deep Creek are likely the result of farming and grazing practices.

Fivemile Creek—Fivemile Creek enters the Bear River on the right bank just west of Preston and upstream of the Highway 36 bridge and was sampled at two locations during 2015. Upper Fivemile Creek upstream of Dayton was normally dry. On May 28, however, a cloud burst created a runoff event with very turbid water (390 NTUs, Table 19). Lower Fivemile Creek at 2200 W was monitored on nine occasions during 2015. No exceedances of temperature criteria were observed, and turbidity tended to be quite low (<16 NTUs, Table 19) in Lower Fivemile Creek. Sediment may settle out from Fivemile Creek because there are several irrigation diversions, including one impoundment directly above the sampling location at 2200 W. *E. coli* bacteria levels in Fivemile Creek at the road crossing at 2200 W exceed Idaho's water quality standards (Table 20), indicating that a TMDL for *E. coli* is necessary.

Weston Creek and Black Canyon—Weston Creek enters the Bear River near Weston and was monitored at two locations in 2015. Black Canyon is a tributary to Weston Creek that is heavily impacted by adjacent agricultural practices. Average turbidity in Black Canyon was 105.5 NTUs although average discharge was just 0.47 cfs (Table 19). Exceedances of TSS and TP targets are common. The bed of Black Canyon is covered in a thick layer of fine sediment (Figure 28). On July 14, an exceedance of temperature criteria was observed with a measured water temperature of 22.26 ˚C at 15:14.

Weston Creek was monitored at 5600 W during 2015. On May 28, turbidity was elevated corresponding to likely exceedances of TMDL targets (Table 19). In July and August, however, no exceedances of TMDL targets were observed. Other water quality parameters (dissolved oxygen, pH, and temperature) were within water quality criteria during all sampling events.

Figure 28. Black Canyon (ID16010202BR020_02a) is heavily impacted by adjacent agricultural practices as evidenced by thick layer of fine sediment in the channel bed.

Cub River and tributaries—The Cub River enters the Bear River in Utah. Maple Creek is a major tributary to the Cub River that enters it near Franklin City. Maple Creek was monitored at three locations in 2015, including one of its tributaries, Crooked Creek. All sampling locations on Maple Creek had no exceedances of TMDL targets and the water tended to be clear and cold. Crooked Creek was sampled in April and June but was dry by July 20. Upper Maple always had higher flows than observed in Lower Maple Creek because of diversions for irrigation (Table 19). While Upper Maple Creek met water quality standards for *E. coli* bacteria, Lower Maple Creek had extremely elevated levels of *E. coli* bacteria that were 10 times higher than water quality standards (Table 20). Many livestock operations exist in the area, and contaminated runoff is likely making its way to Lower Maple Creek.

Cub River—The Cub River was monitored at two locations in Idaho during the 2015 study, at 3200 E and 4800 S. At both locations, turbidity tended to be quite low, and no exceedances of water quality standards or TMDL targets were observed (Table 19). The Cub River is heavily diverted for irrigation, and summertime flows tend to be quite low.

Worm Creek—Worm Creek enters the Cub River in Utah and was monitored at 4800 S in 2015. This tributary is heavily impacted by adjacent agricultural land use and lack of riparian buffers (Figure 29). The stream exceeded TMDL targets for TSS and TP in April, and TP targets were also exceeded in July (Table 19). While no exceedances of temperature criteria were observed, water temperatures were over 20 ˚C in June, July, and August. Dissolved oxygen was super saturated during all monitoring events, indicating that it may experience large diel swings and oxygen deficits may occur during the night.

Figure 29. Lack of riparian buffers and eroding streambanks are common on Worm Creek (ID16010202BR005_02b).

Lower Bear/Malad HUC 16010204 Tributaries

The Malad River subbasin contains the Malad River and its tributaries: Devil Creek, Deep Creek, Wright Creek, and Little Malad River. Tributaries to Devil Creek that are under the 2006 TMDL include Campbell and Evans Creeks. Indian Mill Creek is a tributary to Wright Creek. Wright Creek is a tributary to Daniels Reservoir in the Little Malad River watershed. Table 21 provides monitoring locations, and Table 22 provides the monitoring results. Many AUs in the Malad subbasin are on the §303(d) list for *E. coli* and were sampled in 2015 (Table 23).

Table 21. Description and location of monitoring locations in the Lower Bear/Malad subbasin.

Water Body	Assessment Unit Number	Location	Coordinates (decimal degrees)
Malad River	ID16010204BR001_04	At Samaria Road	42.08767 -112.25002
Malad River	ID16010204BR001_04	At Woodruff Road	42.02989 -112.23026
Devil Creek[a]	ID16010204BR002_02	At Old Highway 191	42.84851 -112.43850
Campbell Creek[a]	ID16010204BR002_02a	At Old Highway 191	42.28596 -112.20628
Evans Creek	ID16010204BR002_02c	At Old Highway 191	42.25027 -112.21473
Devil Creek	ID16010204BR002_03	Below Dam	42.29348 -112.20569
Devil Creek[a]	ID16010204BR002_03	At 1000 N	42.19958 -112.28809
Devil Creek	ID16010204BR002_03	At Highway 38	42.16674 -112.27972
Susan Hollow	ID16010204BR006_02	Above Deep Creek Reservoir	42.20201 -112.16900
Second Creek	ID16010204BR006_02b	Off Highway 36	42.20745 -112.16003
Elkhorn Creek	ID16010204BR008_02a	Above confluence with Little Malad River	42.28808 -112.39878
Little Malad River[a]	ID16010204BR008_04	At Elkhorn Canyon Road	42.28800 -112.39911
Little Malad River	ID16010204BR008_04	At Highway 38	42.15623 -112.30011
Indian Mill Creek	ID16010204BR010_02a	At USFS boundary	42.37270 -112.36482
Indian Mill Creek	ID16010204BR010_02a	At Perlite Road	42.38418 -112.40308
Upper Wright Creek	ID16010204BR010_02b	At USFS Road 043	42.44085 -112.31305
Upper Wright Creek[a]	ID16010204BR010_02b	Just above USFS boundary	42.43482 -112.34114

Water Body	Assessment Unit Number	Location	Coordinates (decimal degrees)
Middle Wright Creek[a]	ID16010204BR010_03	At Perlite Road	42.40607 -112.39001
Lower Wright Creek[a]	ID16010204BR010_04	At 13000 N	42.37282 -112.43538

a. E. coli sampling was conducted at this location.
AU locations can be viewed at *https://mapcase.deq.idaho.gov/wq2014/* .

Table 22. Measured discharge and turbidity and estimated TSS and TP concentrations and loads in water bodies in the Lower Bear/Malad subbasin.

Water Body	Location	Date	Discharge (cfs)	Turbidity (NTUs)	TSS (mg/L)	TP (mg/L)	TSS load (kg/day)	TP load (kg/day)
Malad River	At Samaria Road	3/10/2015	18.19	3.9	0	<0.019	0.0	<0.854
		4/21/2015	3.45	10.2	10	0.034	76.1	0.285
		5/27/2015	31.92	4.1	0	<0.019	0.0	<1.499
		7/15/2015	1.84	0.0	0	<0.019	0.0	<0.086
		8/28/2015	1.11	1.0	0	<0.019	0.0	<0.052
		Mean	11.30	3.8	2	0.022	15.2	0.555
		St deviation	13.49	4.0	4	0.007	34.0	0.618
Malad River	At Woodruff Road	3/10/2015	—	17.7	23	0.054	—	—
		4/21/2015	11.32	27.0	39	0.078[a]	1009.3	2.161
		5/27/2015	28.35	29.7	44	0.085[a]	2833.6	5.905
		7/15/2015	9.15	27.1	39	0.078[a]	820.6	1.754
		8/28/2015	9.64	19.3	26	0.058	564.2	1.363
		Mean	14.62	24.2	34	0.071	1306.9	2.796
		St deviation	9.20	5.3	9	0.014	1034.0	2.098
Devil Creek	At Old Highway 191	3/12/2015	3.93	7.9	6	0.028	50.5	0.266
		5/27/2015	6.81	39.4	61	0.111[a]	944.6	1.844
		7/15/2015	5.09	9.5	8	0.032	98.0	0.397
		8/3/2015	4.72	6.2	3	0.023	28.6	0.268
		8/6/2015	5.02	8.5	7	0.029	76.6	0.359
		8/11/2015	5.18	8.3	6	0.029	74.9	0.364
		8/14/2015	4.83	35.4	54	0.100[a]	592.7	1.184
		8/18/2015	5.13	10.7	11	0.035	123.4	0.440
		Mean	5.09	15.7	19	0.048	248.7	0.640
		St deviation	0.80	13.5	24	0.036	335.6	0.570
Campbell Creek	At Old Highway 191	7/15/2015	Dry	—	—	—	—	—
		8/3/2015	—	10.9	11	0.036	—	—
		8/6/2015	—	58.5	95[a]	0.161[a]	—	—
		8/11/2015	—	60.1	97[a]	0.165[a]	—	—
		8/14/2015	—	68.3	112[a]	0.187[a]	—	—
		8/18/2015	—	11.3	12	0.037	—	—
		Mean	—	41.8	65[a]	0.117[a]	—	—
		St deviation	—	28.3	50	0.075	—	—

Water Body	Location	Date	Discharge (cfs)	Turbidity (NTUs)	TSS (mg/L)	TP (mg/L)	TSS load (kg/day)	TP load (kg/day)
Evans Creek	At Old Highway 191	7/15/2015	Dry	—	—	—	—	—
Devil Creek	Below Dam	7/15/2015	39.99	1.1	0	<0.019	0.0	<1.878
Devil Creek	At 1000 N	8/3/2015	10.79	39.3	61[a]	0.110[a]	1492.3	2.915
		8/6/2015	6.07	44.6	70[a]	0.124[a]	968.0	1.848
		8/11/2015	1.18	14.3	17	0.045	45.3	0.129
		8/14/2015	0.47	18.0	23	0.054	25.0	0.062
		8/18/2015	0.32	15.6	19	0.048	14.0	0.038
		Mean	3.77	26.4	38	0.076[a]	508.9	0.998
		St deviation	4.58	14.4	25	0.038	684.1	1.318
Devil Creek	At Highway 38	3/10/2015	1.10	6.4	3	0.024	7.6	0.064
		5/27/2015	0.04	165.5	283[a]	0.443[a]	25.7	0.043
		7/15/2015	Dry	—	—	—	—	—
		8/3/2015	Dry	—	—	—	—	—
		Mean	0.57	86.0	143[a]	0.233[a]	16.6	0.054
		St deviation	0.75	112.5	198	0.296	12.8	0.014
Susan Hollow	Above Deep Creek Reservoir	3/12/2015	0.05	2.8	0	<0.019	0.0	<0.002
		5/27/2015	0.23	4.0	0	<0.019	0.0	<0.011
		7/15/2015	—	1.0	0	<0.019	—	—
		Mean	0.14	2.6	0	<0.019	0.0	<0.007
		St deviation	0.13	1.5	0	0.000	0.0	0.006
Second Creek	Off Highway 36	3/12/2015	0.41	66.6	109[a]	0.182[a]	101.4	0.183
		5/27/2015	5.60	126.2	214[a]	0.339[a]	2718.6	4.651
		7/15/2015	1.03	13.9	16	0.043	37.9	0.110
		8/28/20115	0.63	7.2	4	0.026	6.3	0.040
		Mean	1.92	53.5	86[a]	0.148[a]	716.1	1.246
		St deviation	2.47	55.3	97	0.146	1335.6	2.271
Elkhorn Creek	Above confluence with Little Malad River	5/27/2015	0.04	21.0	29	0.062	2.6	0.006
		7/15/2015	Dry	—	—	—	—	—
Little Malad River	At Elkhorn Canyon Road	3/10/2015	3.57	2.4	0	<0.019	0.0	<0.168
		5/27/2015	9.16	2.3	0	<0.019	0.0	<0.430
		7/15/2015	35.55	17.9	23	0.054	1877.4	4.700
		8/3/2015	25.92	14.8	18	0.046	1047.8	2.909
		8/6/2015	23.74	15.3	19	0.047	1007.1	2.741
		8/11/2015	21.23	11.2	11	0.036	552.9	1.890
		8/14/2015	13.12	7.9	6	0.028	168.7	0.889
		8/18/2015	13.42	6.7	4	0.025	108.2	0.805
		Mean	18.21	9.8	10	0.034	595.3	1.816
		St deviation	10.32	5.9	9	0.014	670.6	1.553

Water Body	Location	Date	Discharge (cfs)	Turbidity (NTUs)	TSS (mg/L)	TP (mg/L)	TSS load (kg/day)	TP load (kg/day)
Little Malad River	At Highway 38	3/10/2015	0.08	57.9	94[a]	0.159[a]	17.0	0.031
		5/27/2015	0.31	8.1	6	0.028	4.2	0.021
		7/15/2015	Dry	—	—	—	—	—
		Mean	0.20	33.0	50	0.094	10.6	0.026
		St deviation	0.16	35.2	62	0.093	9.0	0.007
Indian Mill Creek	At USFS boundary	3/10/2015	0.82	4.3	0	<0.019	0.0	<0.039
		7/15/2015	1.00	6.5	3	0.024	7.3	0.059
		Mean	0.91	5.4	2	0.022	3.6	0.049
		St deviation	0.13	1.6	2	0.003	5.1	0.014
Indian Mill Creek	At Perlite Road	5/27/2015	1.74	29.0	43	0.083[a]	169.0	0.355
		7/15/2015	0.70	18.7	25	0.056	39.2	0.096
		Mean	1.22	23.9	34	0.070	104.1	0.225
		St deviation	0.74	7.3	13	0.019	91.8	0.183
Upper Wright Creek	At USFS Road 043	5/27/2015	—	0.0	0	<0.019	—	—
		7/15/2015	—	7.5	5	0.027	—	—
		Mean	—	3.8	2	0.023	—	—
		St deviation	—	5.3	4	0.005	—	—
Upper Wright Creek	Just above USFS boundary	8/3/2015	0.01	70.4	115[a]	0.192[a]	2.6	0.005
		8/6/2015	0.01	63.0	102[a]	0.173[a]	2.3	0.004
		8/11/2015	0.05	61.9	101[a]	0.170[a]	12.2	0.022
		8/14/2015	—	71.6	118[a]	0.196[a]	—	—
		8/18/2015	—	76.0	125[a]	0.207[a]	—	—
		Mean	0.02	68.6	112[a]	0.188[a]	5.7	0.010
		St deviation	0.03	6.0	11	0.016	5.6	0.010
Middle Wright Creek	At Perlite Road	3/10/2015	1.17	9.2	8	0.031	21.1	0.089
		5/27/2015	2.57	85.0	141[a]	0.231[a]	824.6	1.452
		7/15/2015	0.74	51.5	82[a]	0.143[a]	138.4	0.258
		8/3/2015	0.53	22.0	30	0.065	36.7	0.084
		8/6/2015	0.71	33.6	51	0.095[a]	82.0	0.166
		8/11/2015	0.75	28.0	41	0.081[a]	69.5	0.147
		8/14/2015	0.57	28.9	43	0.083[a]	55.2	0.116
		8/18/2015	0.48	40.2	62[a]	0.113[a]	68.1	0.132
		Mean	0.94	37.3	57	0.105[a]	162.0	0.306
		St deviation	0.69	22.9	40	0.060	270.0	0.466
Lower Wright Creek	At 13000 N	3/10/2015	2.22	10.3	10	0.034	49.8	0.185
		5/27/2015	4.04	84.1	140[a]	0.229[a]	1281.8	2.259
		7/15/2015	1.60	19.0	25	0.057	91.5	0.223
		8/3/2015	1.23	19.7	26	0.059	73.8	0.177
		8/6/2015	1.57	33.6	51	0.095[a]	181.4	0.367
		8/11/2015	1.30	34.5	52	0.098[a]	155.4	0.312

Water Body	Location	Date	Discharge (cfs)	Turbidity (NTUs)	TSS (mg/L)	TP (mg/L)	TSS load (kg/day)	TP load (kg/day)
		8/14/2015	—	39.7	62[a]	0.111[a]	—	—
		8/18/2015	1.20	35.5	54	0.100[a]	147.7	0.295
		Mean	1.88	34.6	52	0.098[a]	283.1	0.545
		St deviation	1.01	22.5	39	0.059	443.0	0.759

a. TP or TSS targets were likely exceeded.

Table 23. *E. coli* data for AUs sampled in 2015 in the Malad subbasin (HUC 16010204).

Water Body	Location	Date	*E. coli* (cfu/100 mL)
Campbell Creek	At Old HWY 191	8/3/2015	2,420
		8/6/2015	652
		8/11/2015	582
		8/14/2015	730
		8/18/2015	870
		Geometric mean	898
Devil Creek	At Old HWY 191	8/3/2015	517
		8/6/2015	411
		8/11/2015	579
		8/14/2015	2,420
		8/18/2015	520
		Geometric mean	689
Devil Creek	At 1000 N	8/3/2015	1,300
		8/6/2015	690
		8/11/2015	921
		8/14/2015	1,733
		8/18/2015	1,034
		Geometric mean	1,082
Little Malad River	At Elkhorn Canyon Rd.	8/3/2015	228
		8/6/2015	66
		8/11/2015	24
		8/14/2015	46
		8/18/2015	125
		Geometric mean	73
Upper Wright Creek	Above USFS boundary	8/3/2015	2,420
		8/6/2015	4,840
		8/11/2015	9,800
		8/14/2015	4,840
		8/18/2015	19,860
		Geometric mean	6,435

Water Body	Location	Date	*E. coli* (cfu/100 mL)
Middle Wright Creek	At Perlite Rd	8/3/2015	1,046
		8/6/2015	472
		8/11/2015	616
		8/14/2015	870
		8/18/2015	2,092
		Geometric mean	888
Lower Wright Creek	At 13000 N	8/3/2015	2,420
		8/6/2015	3,466
		8/11/2015	2,240
		8/14/2015	1,096
		8/18/2015	428
		Geometric mean	1,545

Wright Creek—Wright Creek is a tributary to Daniels Reservoir and contains a 2nd-, 3rd-, and 4th-order segment, all of which were sampled in 2015. Wright Creek is impacted by cattle that have direct access to the stream along its length, resulting in high turbidity and exceedances of TMDL targets for TSS and TP. The 2nd-order segment of Wright Creek on USFS land lacks a defined channel due to trampling. This portion of the stream had high turbidity (> 60 NTUs) in August that corresponded to exceedances of TSS and TP (Table 22). Temperature exceeded water quality standards on August 11. Dissolved oxygen was below the water quality standard of 6 mg/L on July 15 and August 11. Bacteria levels were over 50 times Idaho's water quality standard (Table 23), indicating this AU is not supporting its recreational beneficial uses.

We measured the 3rd-order segment of Wright Creek at the Perlite Road crossing below the perlite mining operation. Turbidity was high, correlated to exceedances of TSS and TP targets (Table 22). Water temperature did not exceed water quality standards during sampling, and dissolved oxygen was in excess of 7.5 mg/L during all observations. This AU is impacted by mining activities and road maintenance. *E. coli* bacteria levels were in excess of state water quality standards but considerably below levels observed in the 2nd-order segment (Table 23). Additional water from tributaries likely dilutes bacteria concentrations, but levels are still 7 times higher than the standard.

The 4th-order segment of Wright Creek was monitored at 13000 N above Daniels Reservoir. Turbidity tended to be high, and TMDL targets were exceeded (Table 22). The stream is entrenched and banks are uncovered and unstable in places (Figure 30). The lack of riparian vegetation likely leads to exceedances of temperature criteria. For example, on August 11 and 13, water temperatures were over 23 ˚C. This AU also had high bacteria levels (Table 23), indicating that it is not supporting its recreational beneficial use.

Figure 30. Unstable and uncovered streambanks along Wright Creek (ID16010204BR010_04) at 13000 N.

Indian Mill Creek—Indian Mill Creek is a tributary to Wright Creek that was monitored at the USFS boundary and Perlite Road. Water tended to be relatively clear and cold, although the TP target was exceeded during spring runoff (Table 22).

Little Malad River—Below Daniels Reservoir, the Little Malad River flows south. This stream was monitored at two locations in 2015, at Elkhorn Canyon Road and at Highway 38. At Elkhorn Canyon Road, no exceedances of TMDL targets or water quality standards were documented, and bacteria levels were below water quality standards (Table 23). This AU is fully supporting its recreational beneficial use. By Highway 38, however, flows are greatly reduced and water quality is degraded. In March, TMDL targets for TSS and TP were exceeded. By July, the Little Malad River was dry at Highway 38.

Elkhorn Creek—Elkhorn Creek is a tributary to the Little Malad River that was monitored in 2015. This stream is diverted for irrigation and was dry at North Daniels Road by July. The creek runs through a corral above its confluence with the Little Malad River.

Tributaries to Deep Creek Reservoir (Susan Hollow and Second Creek)—Two tributaries to Deep Creek Reservoir were monitored in 2015, Susan Hollow and Second Creek. Susan Hollow is a small tributary where flows were low and the water was clear and cold. We did not document any exceedances of TMDL targets or water quality standards in Susan Hollow (Table 22). Second Creek is listed in the most recent Integrated Report as fully supporting beneficial uses. The lower portion of Second Creek, however, flows through a cattle winter feeding operation (Figure 31). TMDL targets were exceeded in March and May 2015 (Table 22). When cattle were moved to the range during the summer months, turbidity dropped and water quality improved in Second Creek.

Figure 31. Second Creek (ID16010204BR006_02b) as it flows through a winter feeding operation. Photo taken from Highway 36.

Devil Creek and tributaries (Campbell and Evans Creeks)—Devil Creek and two of its tributaries were monitored as part of the sampling effort in 2015. The 2nd-order segment of Devil Creek was monitored above the reservoir at the Highway 191 crossing. TP targets in this section of Devil Creek were exceeded in May and August (Table 22). *E. coli* bacteria levels (geometric mean of 686 cfu/100 mL) also exceeded water quality standards (Table 23).

Evans and Campbell Creeks enter Devil Creek below Devil Creek Reservoir. Evans Creek was dry throughout the sampling effort in 2015. Campbell Creek flows through an animal feeding operation (AFO) above Highway 191 where cattle have direct access to the stream. Flow is very low in Campbell Creek, but turbidity is high and correlated with exceedances of TMDL targets for TSS and TP (Table 22). *E. coli* bacteria levels (geometric mean of 898 cfu/100 mL) also exceeded water quality standards (Table 23).

Devils Creek was monitored below the reservoir, at 1000 N just north of Malad, and at Highway 38, west of Malad. At Highway 38, Devils Creek is highly entrenched and banks are unstable and uncovered (Figure 32). This section of the creek had high turbidity in May (165.5 NTUs) that correlated to exceedances of TMDL targets (Table 22). By July, the creek was dry. Devils Creek at 1000 N exceeded TMDL targets for TSS and TP in August (Table 22). This section of Devil Creek also exceeded water quality standards for *E. coli* (geometric mean of 1,082 cfu/100 mL, Table 23).

Figure 32. Devil Creek (ID16010204BR002_03) is highly entrenched and lacks riparian vegetation at Highway 38.

Malad River—The Malad River flows generally south from the Pleasantview Hills to Utah. This stream was monitored at two locations in 2015, at Samaria and Woodruff Roads. At Samaria Road, the Malad River did not exceed TMDL targets for TSS or TP (Table 22). Water quality standards for temperature were exceeded on July 15 at both monitoring locations (23.69 ˚C and 22.24 ˚C at Samaria and Woodruff Roads, respectively). As the Malad River flows south from Samaria Road to Woodruff Road just above the Idaho-Utah border, turbidity and conductivity increase. For example at Samaria Road, conductivity was 1.036 ms/cm^2. While at Woodruff Road, conductivity was as 8.043 ms/cm^2 on the same day. The Malad River likely flows through an alkaline flat where springs enter the river and alter its chemistry. Land use also likely contributes to the degraded water quality observed at Woodruff Road. TMDL targets for TSS and TP were exceeded at this site on multiple occasions in 2015 (Table 22).

3.3.4 Main Stem Water Quality Data

Since 2006, the Bear River has been sampled approximately four times per year at 21 locations in Wyoming, Idaho, and Utah (Table 24, Figure 33). Sites 6 through 17 are located in Idaho and are the focus on this analysis (results are displayed in Table 25). Samples are intended to represent distinct hydrologic periods including lower basin runoff (March and April), upper basin runoff (May and June), summer base flow (July–September), and winter base flow (October–February). A grab sample of water is collected from the water surface above the thalweg of the river by lowering a churn with a rope from a bridge. Samples are dispensed from the churn into bottles provided by the laboratory. Water samples are analyzed for TSS, ammonia, nitrate, total Kjeldahl nitrogen, orthophosphate, and TP. Water quality parameters (temperature, specific conductivity, dissolved oxygen, pH, and turbidity) are also measured at three locations across the channel with a calibrated multiparameter sonde. Flows are obtained from USGS gages, PacifiCorp, and/or the Bear River Commission (DEQ 2006b).

Table 24. Descriptions and locations of tri-state monitoring sampling points in Idaho.

Monitoring Location	Name	Description	Location		
			Latitude	Longitude	Elevation
BR-06	Idaho-Wyoming Border	USGS gage station down river of border	N 42.211197°	W 111.053299°	6064
BR-07	Rainbow Canal	Rainbow Canal above Stewart Dam	N 42.250329°	W 111.288589°	5948
BR-08	Bear Lake Inlet	East of outlet near North Beach State Park	N 42.120264°	W 111.299034°	5934
BR-09	Bear Lake Outlet	Bear Lake outlet at Lifton pump station	N 42.122784°	W 111.315097°	5934
BR-10	Paris Dike	Outlet Canal beneath Mud Lake	N 42.208155°	W 111.339871°	5932
BR-11	Pescadero	USGS gage 10068500	N 42.400874°	W 111.354877°	5918
BR-12	Above Alexander Reservoir	Road crossing above Alexander Reservoir	N 42.649355°	W 111.617240°	5730
BR-13	Below Grace Dam	Downstream of Grace Dam where Highway 34 crosses Bear River	N 42.586013°	W 111.730310°	5530
BR-14	Below Cove Power Plant	Road crossing below Cove power plant (near Cheese Plant)	N 42.494955°	W 111.791969°	4929
BR-15	Above Oneida Reservoir	Highway 34 crossing above Oneida Narrows	N 42.346769°	W 111.713442°	4906
BR-16	Below Oneida Reservoir	Road crossing below Oneida station	N 42.263672°	W 111.752952°	4764
BR-17	Idaho-Utah Border	Road crossing near border, 3900 S Road in Idaho	N 42.029571 °	W 111.921775°	4450

Overall, Bear River water entering (BR-06) and leaving (BR-17) Idaho did not differ in terms TSS or TP concentrations (Table 25). Between 2006 and 2015, mean TSS was 42 mg/L when it entered Idaho and 37 mg/L when it left (Figure 34**Error! Reference source not found.**). Similarly, mean TP concentration was 0.081 mg/L as the Bear River entered Idaho and 0.072 mg/L when the Bear River entered Utah (Table 25). On average, TP concentrations exceed TMDL targets, while TSS does not. In contrast, nitrogen concentrations tend to increase in the Bear River as it travels through Idaho. Mean TN concentration was 73% higher at the Idaho-Utah border (0.85 mg/L) than at the Idaho-Wyoming border (0.49 mg/L, Table 25, Figure 35).

Timing of peak flow also differed along the Bear River as it travels through Idaho, influencing water quality. The United States Geological Survey (USGS) maintains three stream gages on the Bear River in Idaho, one at the Idaho-Wyoming border, one downstream of the Bear Lake Outlet Canal at Pescadero, and one near the Idaho-Utah border south of Preston. Average daily flows were compared for equal periods from 1970 to 2015 (Figure 36). As the Bear River enters Idaho, peak flows typically occur in June and reach 1,300 cfs. Base flow occurs from September to February near 200 cfs. At Stewart Dam near Dingle, nearly the entire Bear River is diverted into the Rainbow Canal and routed to Mud Lake and then Bear Lake or to the Bear Lake Outlet Canal depending on lake levels and irrigation demands. In the summer, water is pumped out of the Bear Lake at Lifton into the Bear Lake Outlet Canal. The Bear Lake Outlet Canal then flows into the original Bear River channel just north of Highway 89 by Montpelier.

The operation of Bear Lake as a storage reservoir for irrigation influences timing of peak flow and water quality in the Bear River as it flows north from Montpelier to Alexander Reservoir in Soda Springs. At Pescadero, peak flow tends to be slightly higher than at the Idaho-Wyoming border and occurs later (Figure 36). For example, peak flows occur in July and flow remains elevated into August. As a result, TSS concentrations in the Bear River below the Outlet Canal (BR-10–BR-12) remain elevated in the summer instead of subsiding as occurs at the Idaho-Wyoming border (BR-06, Figure 34). Monitoring results are discussed in relation to TMDL loads later in this discussion (Table 27–Table 34).

TSS and TP concentrations tended to reflect hydrologic management and channel conditions as measured by interval photography via canoe surveys. For example, monitoring locations below reservoirs (BR-09, BR-13, and BR-16) tended to have low TSS and TP concentrations during all hydrologic periods because the reservoirs (Bear Lake, Alexander, and Oneida Narrows) act as settling basins for sediment and associated phosphorus (Figure 34 and Figure 37). Channel conditions in between river reaches were also correlated with TSS and TP concentrations. For example, channel conditions were the least impacted in the Nounan section of the river between the Bear Lake Outlet Canal and Alexander Reservoir. In this reach of the river where bank stabilities and levels of woody riparian vegetation were highest, TSS concentration did not increase as the river flowed downstream (BR-11 to BR-12). In contrast, sections of the river that had low bank stabilities tended to be correlated with increases in TSS concentrations. For example, the Gentile Valley below BR-14 had low bank stabilities and TSS concentration increased at BR-15. The same was true for the reach of river between Oneida Reservoir outlet (BR-16) and the Idaho-Utah border (BR-17).

While TSS and TP were correlated with hydrologic management and channel conditions, nitrogen concentrations likely reflected ground water inputs and adjacent land use practices. Overall, TN concentrations tended to increase as the Bear River traveled through Idaho (Figure 35). Concentrations were highest in the reach of river between Alexander Reservoir and Oneida Narrows Reservoir (BR-11 through BR-15). Here, agriculture (grazing and crops) directly borders the river with little riparian buffer. This reach also includes many springs and spring creeks as well as fish a hatchery (Bear River Trout Farm) that discharge to the river and likely increase nitrogen concentrations. Also, some winter feed operations on the river and on tributaries likely increase nitrogen concentrations. Unlike TSS concentrations, TN concentrations did not decrease below reservoir. Instead, it appears that nitrogen remains in suspension in reservoirs.

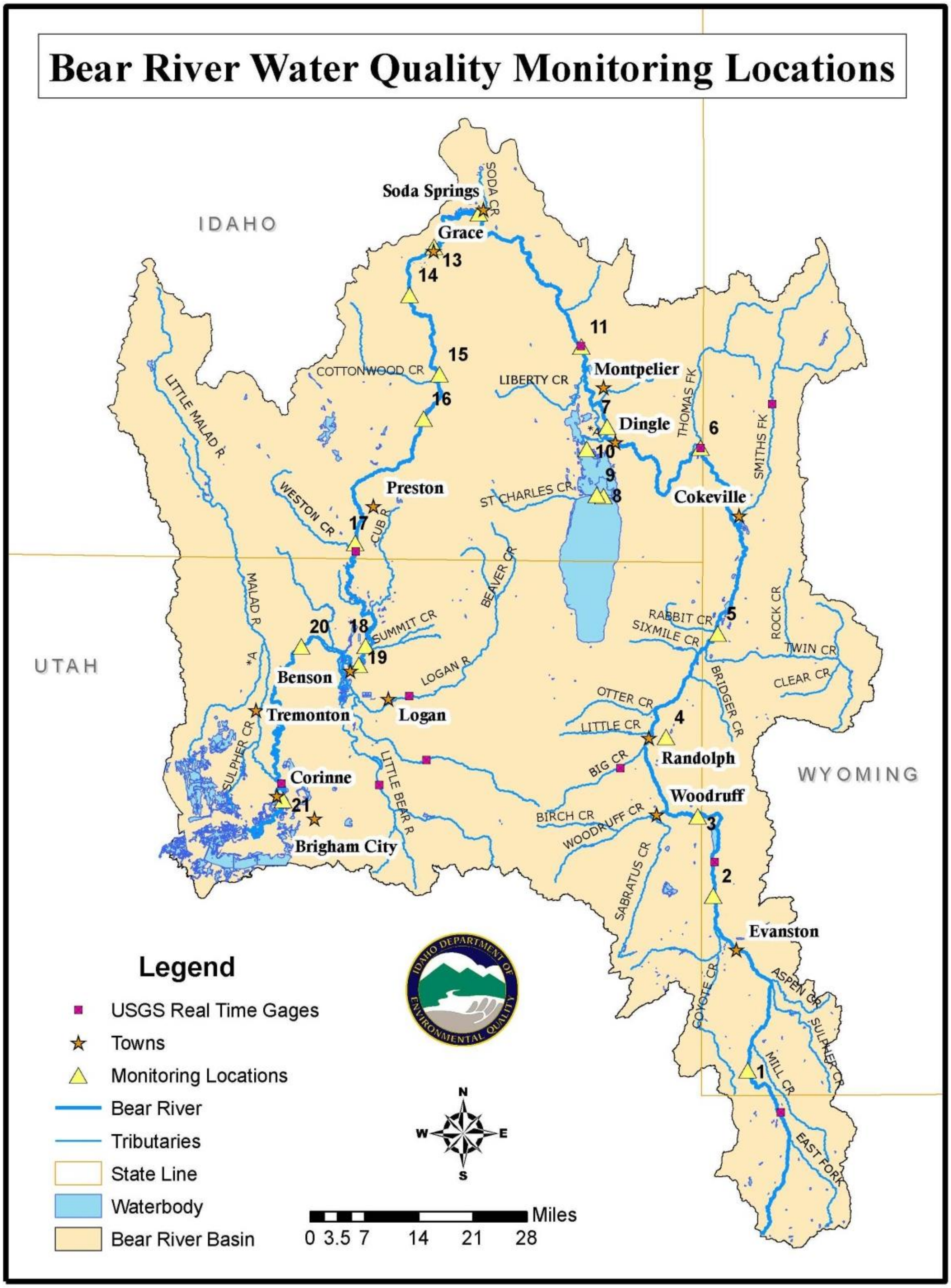


Figure 33. Tri-state monitoring locations on the Bear River.

Table 25. Water quality summary of tri-state monitoring sites in Idaho 2006–2015.

Site #	Site Name	n	TSS (mg/L)					Total N (mg/L)					Total P (mg/L)				
			Mean	Median	St dev	Max	Min	Mean	Median	St dev	Max	Min	Mean	Median	St dev	Max	Min
BR-06	ID/WY Border	35	42	21	49	187	5	0.49	0.40	0.33	1.30	0.05	0.081	0.051	0.073	0.263	0.010
BR-07	Rainbow Canal	34	36	21	36	150	5	0.51	0.43	0.38	2.07	0.08	0.066	0.046	0.057	0.264	0.013
BR-08	Bear Lake Inlet	27	21	13	28	89	5	0.57	0.43	0.42	1.63	0.08	0.045	0.031	0.047	0.168	0.010
BR-09	Bear Lake Outlet	26	7	5	5	26	5	0.42	0.33	0.34	1.73	0.08	0.016	0.016	0.006	0.028	0.007
BR-10	Paris Dike	22	24	19	19	85	5	0.52	0.43	0.28	1.20	0.20	0.050	0.037	0.033	0.142	0.018
BR-11	Pescadero	36	30	25	21	87	5	0.65	0.64	0.28	1.33	0.23	0.066	0.060	0.043	0.252	0.017
BR-12	Above Alexander Reservoir	36	31	18	29	118	5	0.76	0.69	0.34	1.66	0.23	0.059	0.043	0.045	0.201	0.007
BR-13	Below Grace Dam	36	13	11	9	35	5	0.80	0.75	0.39	2.17	0.08	0.046	0.041	0.018	0.082	0.017
BR-14	Below Cove Power Plant	36	15	13	10	36	5	0.94	0.90	0.39	2.11	0.28	0.050	0.048	0.021	0.101	0.011
BR-15	Above Oneida Reservoir	36	33	28	47	295	5	0.98	0.94	0.35	1.83	0.42	0.075	0.071	0.056	0.333	0.011
BR-16	Below Oneida Reservoir	35	6	5	2	12	5	0.84	0.71	0.35	1.75	0.23	0.039	0.044	0.014	0.066	0.014
BR-17	ID/UT Border	36	37	19	75	454	5	0.85	0.78	0.40	1.94	0.08	0.072	0.048	0.087	0.500	0.008

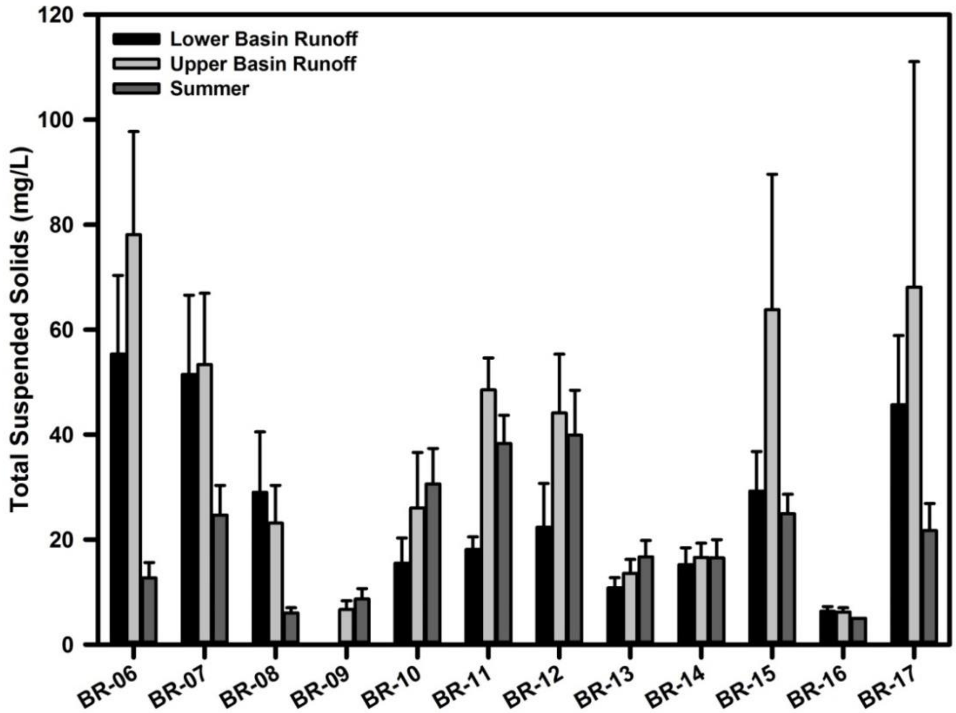


Figure 34. Mean TSS concentrations (± 1 SE) at tri-state monitoring locations on the Bear River in Idaho during different hydrologic periods from 2006–2015.

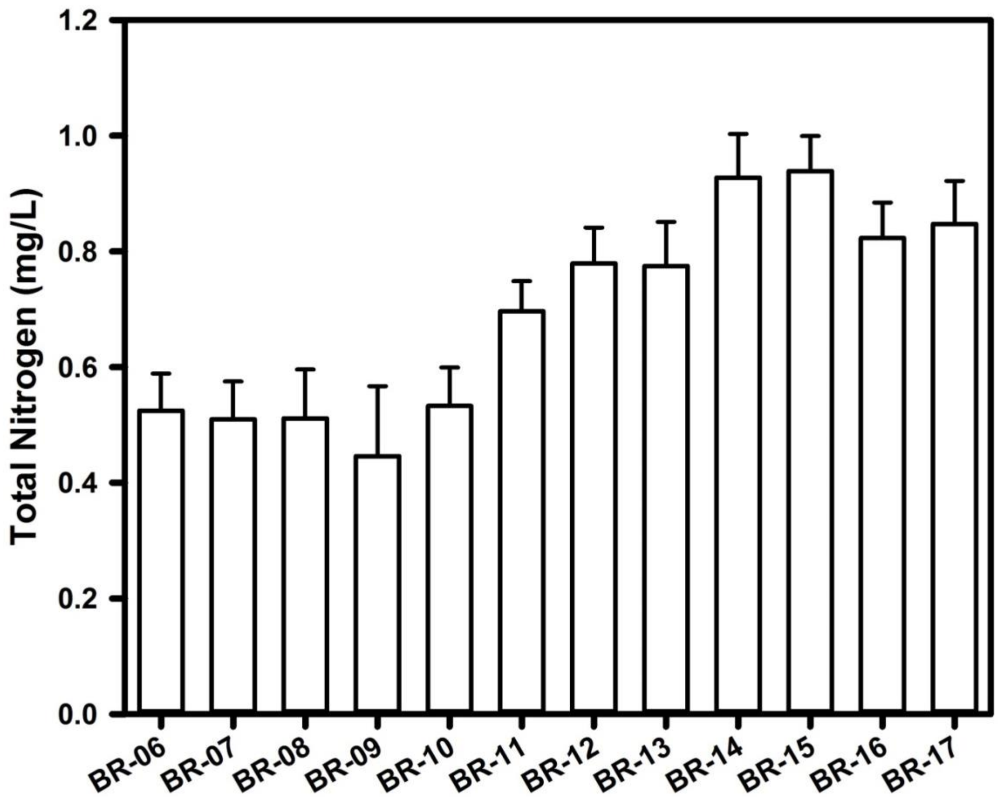


Figure 35. Mean growing season (all samples excluding winter) concentrations of TN (± 1 SE) at tri-state monitoring locations on the Bear River in Idaho from 2006–2015.

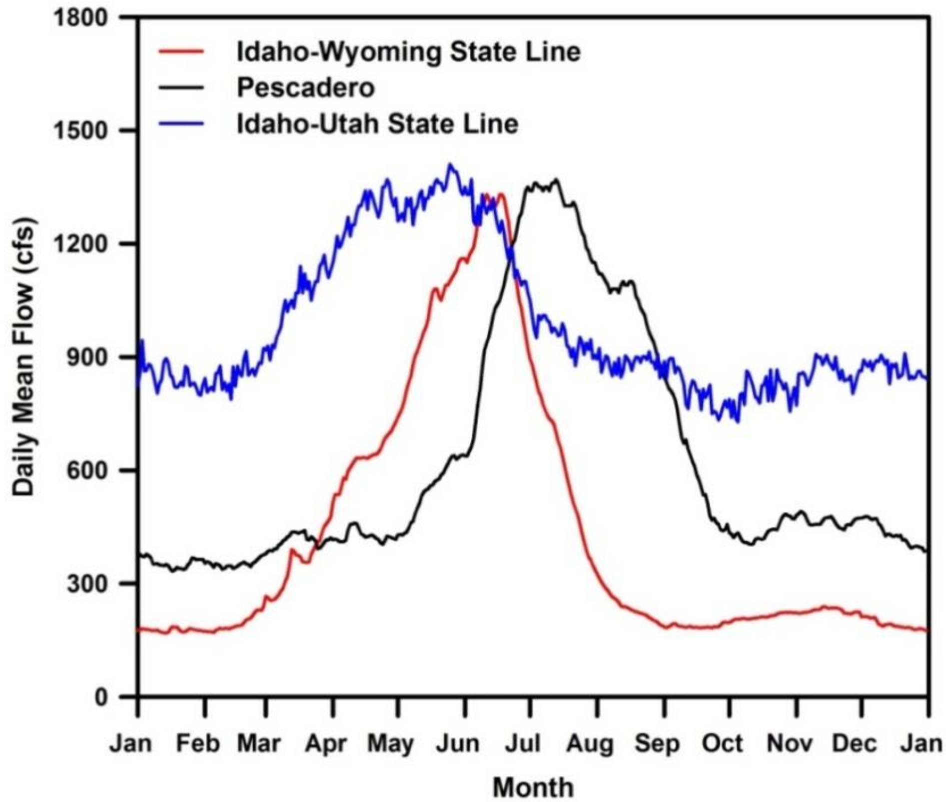


Figure 36. Daily mean flow recorded at USGS gages in Idaho from 1970 to 2015.

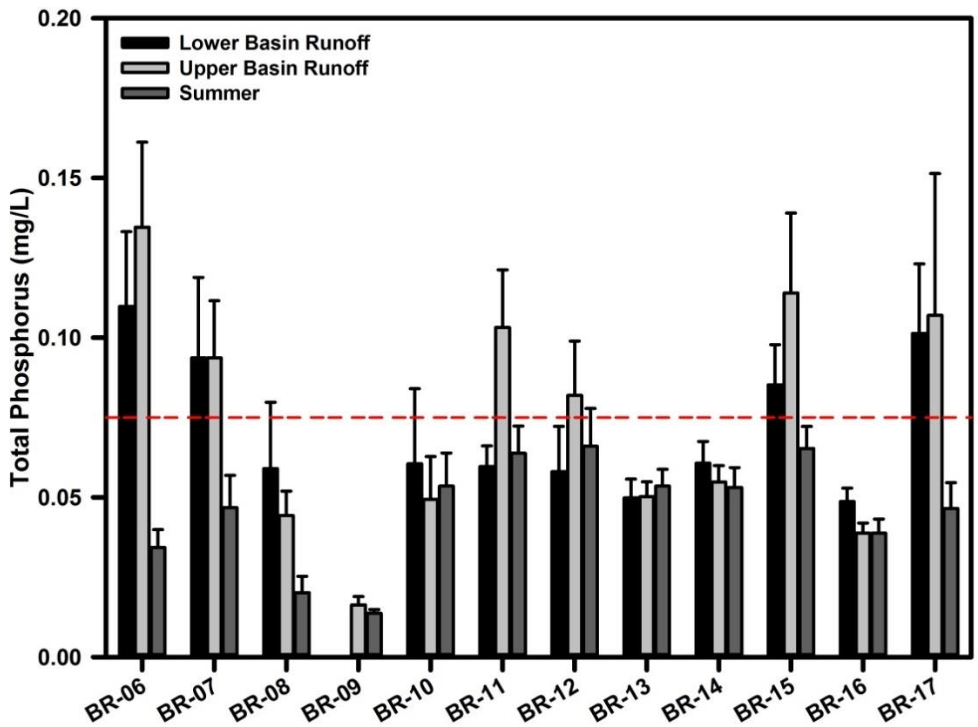


Figure 37. Mean TP concentrations (± 1 SE) at tri-state monitoring locations on the Bear River in Idaho during different hydrologic periods from 2006–2015. Red dashed line represents 0.075 mg/L, the TMDL target.

In aquatic ecosystems, nutrients are required in known ratios for growth, and determining the relative abundance of nitrogen to phosphorus can be useful in predicting which nutrient may be limiting. The Redfield ratio describes the atomic ratio needed by phytoplankton and is a C:N:P ratio of 106:16:1 (Dodds 2002). If we assume that carbon is not limiting in the aquatic system, the relative availability of nitrogen and phosphorus can help predict which nutrient may be limiting growth of autotrophs. For example, if N:P is greater than 16, phosphorus is predicted to be limiting. If N:P is less than 16, nitrogen is likely limiting. Figure 38 displays the mean N:P ratio during the growing season at sites along the Bear River in Idaho. At most sites in Idaho, nitrogen is the likely limiting nutrient, as phosphorus is available in excess. Bear Lake water that is pumped into the Outlet Canal and then enters the Bear River (BR-09) contains relatively little phosphorus, and therefore, phosphorus is likely the limiting nutrient. BR-14 occurs after inputs of nitrogen from ground water and a fish hatchery have entered the river (as discussed above). These inputs of nitrogen may shift the limitation of algal growth from nitrogen to phosphorus. And as the river enters Oneida Reservoir, sediment containing phosphorus settles resulting in primarily phosphorus limitation below the reservoir (BR-16).

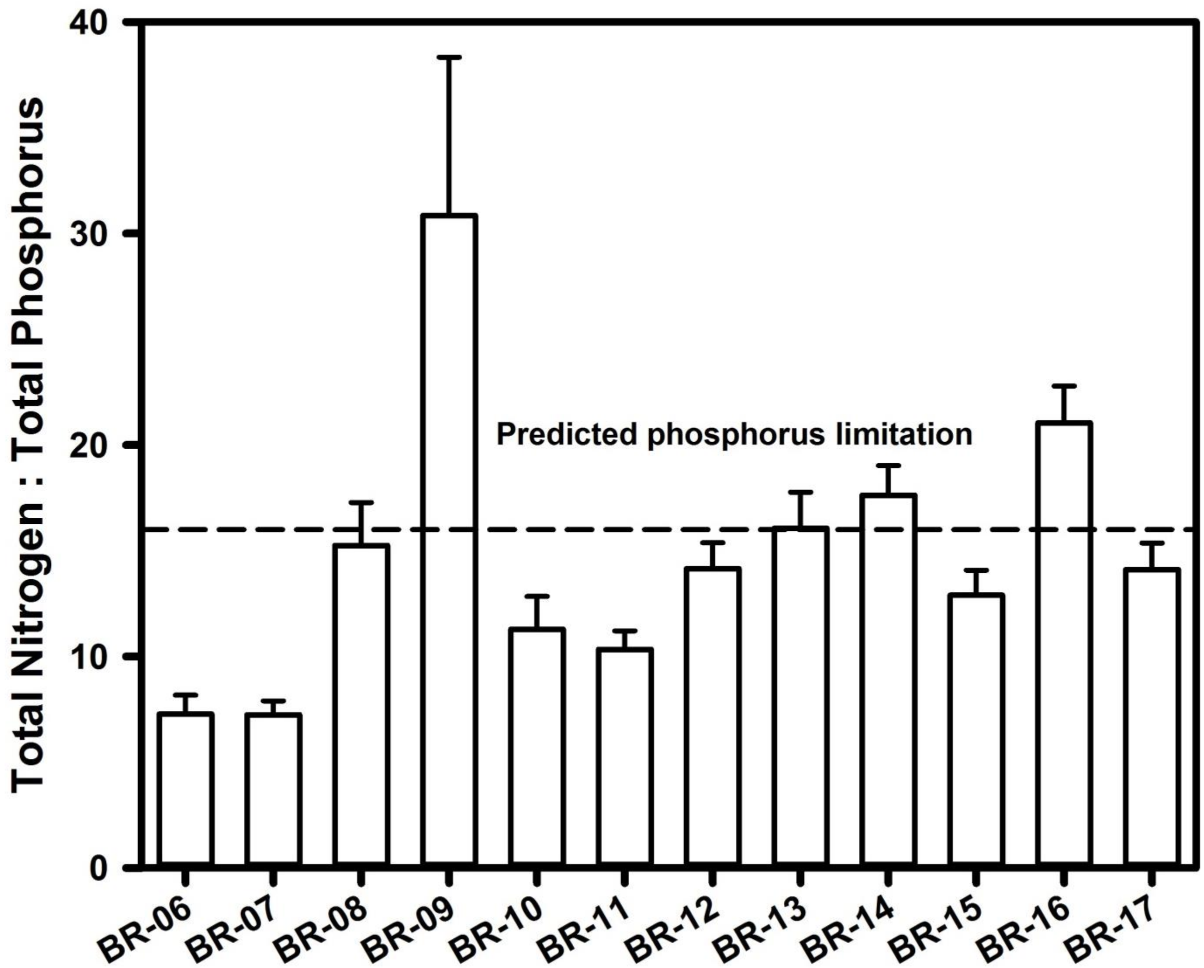


Figure 38. Mean relative availability of total nitrogen to total phosphorus (± 1 SE) in the Bear River at tri-state monitoring locations in Idaho during the growing season (winter samples excluded). Values above 16 indicate potential phosphorus limitation, and values below 16 indicate potential nitrogen limitation.

Comparison with Historic Water Quality Data

The 2006 Bear River TMDL divided the river as it flows through Idaho into four management reaches. Management Reach 1 included the Bear River from the Idaho-Wyoming state line to the causeway at Bear Lake. In the tri-state monitoring sampling scheme, this management reach encompassed BR-06 (Idaho-Wyoming state line), BR-07 (Stewart Dam) and BR-08 (Bear Lake Inlet). Management Reach 2 includes the Bear River from the Bear Lake Outlet to Alexander Reservoir near Soda Springs. TMDLs were set for the Bear Lake Outlet (BR-09), Bear River at Paris Dike (BR-10), and Bear River above Alexander Reservoir (BR-12) within this reach. Management Reach 3 encompasses the Bear River from below Alexander Reservoir to Oneida Reservoir. TMDLs were set for below Alexander Reservoir (BR-13) and above Oneida Reservoir (BR-15) within this reach. Finally, Management Reach 4 includes the Bear River from below Oneida Reservoir (BR-16) to the Idaho-Utah state line (BR-17). Both locations received TMDLs for TSS and TP (Table 26).

Load allocations for the Bear River in Idaho were set for 10 locations in Idaho within the 4 management reaches. TSS and TP loads were calculated in kilograms per day and were specific to each hydrologic period. Tri-state monitoring results (2006–2015) were compared to TMDL loads by hydrologic period (Table 27).

During the current monitoring scheme, sampling sometimes occurred at the Bear Lake Inlet when the inlet was closed and water was not flowing into Bear Lake from that location. These data were removed from analyses because they more closely represent conditions of the lake and not of the inflow from Bear River. Water flows into Bear Lake at the inlet during winter base flow and during runoff conditions. During the summer, however, storage in Bear Lake is used to augment downstream flows to meet irrigation demand, and the inlet is often closed. On many occasions, the Bear Lake Outlet at Lifton was sampled when there was no outflow. These data were excluded from analyses because they also represent lake conditions rather than the outflow. This primarily occurred during the winter and runoff conditions when water is being stored in Bear Lake instead of being directed to the river downstream.

During the winter, no exceedances of TMDL targets were documented during annual sampling from 2006–2015. On average 194 cfs entered Idaho from Wyoming, carrying 6,830 kg TSS and 14 kg TP/day. As the Bear River exited Idaho at the Utah state line, the average flow was 550 cfs carrying 7,652 kg TSS and 27 kg TP/day (Table 27). When comparing historic data (1974–2000) to current (2006–2015) data, reductions in both loads and concentrations of TSS and TP have occurred at several Bear River sites in Idaho during winter base flow (Table 28). Reductions in both TSS and TP concentrations were most pronounced at the Idaho-Wyoming state line, Stewart Dam, above Oneida Reservoir, and Idaho-Utah state line (Figure 39). Reductions in TP but not TSS were evident below Alexander Reservoir. This difference, however, may have resulted from the current versus. historic sampling location being different. Mean TP and TSS concentrations did not differ from historic data at the Paris Dike, Above Alexander Reservoir or Below Oneida Reservoir.

During runoff conditions, exceedances of TMDL loads for TSS and TP are more common than during winter conditions (Table 29-Table 32), both historically and currently. During runoff, exceedances were most common at the Idaho-Wyoming state line, Stewart Dam, Above Oneida Reservoir, and Idaho-Utah state line (Table 29, Table 31, Figure 40). Between 2006 and 2015, exceedances of TSS and TP loads were never documented at the Bear Lake Outlet or below Alexander Reservoir. At the Paris Dike and below Oneida Reservoir, exceedances of TMDL loads were not documented during runoff, although, exceedances of TP loads were documented.

Reductions in TSS and TP concentrations between historic and current sampling periods were not as pronounced during runoff than during winter. For example, TSS concentrations only differed as the Bear River enters Idaho at the Wyoming state line, at Stewart Dam and Paris Dike (Figure 40). TP concentrations were reduced from historic levels at Stewart Dam, Paris Dike, above Alexander Reservoir, and below Oneida Reservoir (Figure 40).

During the summer, TSS loads increase substantially between the Bear Lake Outlet and Paris Dike. Loads increase again between the Dike and above Alexander Reservoir. Below reservoirs (Alexander and Oneida), TSS loads are reduced. Summer exceedances of TSS TMDLs were more common than exceedances of TP TMDLs and occurred most frequently above Alexander and Oneida Reservoirs (Table 33). TP exceedances occurred at all sites except the Bear Lake Outlet and Below Alexander Reservoir (Table 33).

Recent data (2006–2015) indicates decreased summer TSS and TP concentrations as the Bear River enters Idaho and at the Paris Dike compared to historic conditions (1972–2000, Figure 41, Table 34). By the time the river enters Alexander Reservoir, however, TSS and TP concentrations are similar to historic observations. As the Bear River enters Utah (BR-17), TP concentrations are reduced from historic observations. Significant reductions in TSS at this site were not observed.

Table 26. TSS and TP TMDLs (2006). Loads were based on target concentrations multiplied by measured flow.

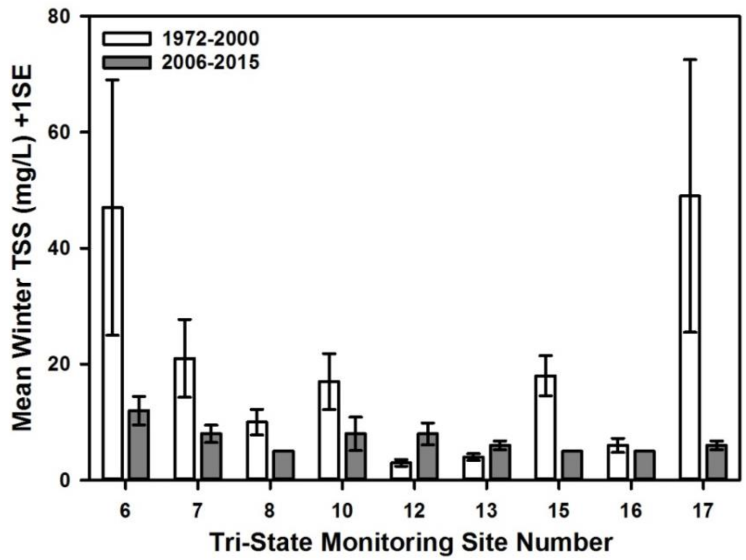
Management Reach	Site Description	Tri-State Number	TMDLs (kg/day)							
			Winter Baseflow		Lower Basin Runoff		Upper Basin Runoff		Summer	
			TSS	TP	TSS	TP	TSS	TP	TSS	TP
1	Idaho-Wyoming State Line	BR-06	35,149	44	115,884	109	229,736	215	30,995	39
	Stewart Dam	BR-07	24,042	34	107,187	89	182,643	152	30,901	44
	Bear Lake Inlet	BR-08	14,343	20	49,860	42	103,223	86	7,931	11
2	Bear Lake Outlet	BR-09	105,271	132	148,753	139	177,103	166	90,933	114
	Paris Dike	BR-10	84,562	106	75,062	70	109,961	103	136,765	171
	Above Alexander	BR-12	49,613	71	73,148	61	148,776	124	75,033	107
3	Below Alexander	BR-13	39,782	50	96,624	91	154,670	145	97,509	122
	Above Oneida	BR-15	39,076	56	114,528	95	133,663	111	63,120	90
4	Below Oneida	BR-16	65,725	55	145,771	91	148,175	93	92,167	77
	Idaho-Utah State Line	BR-17	124,927	104	187,565	117	220,813	138	134,970	112

Table 27. Winter base flow loads (2006–2015).

Management Reach	Site Description	n	Mean Flow (cfs)	Mean TSS Load (kg/day)	Exceedances	Mean TP Load (kg/day)	Exceedances
1	Idaho-Wyoming State Line	6	194	6,830	0	14	0
	Stewart Dam	7	206	4,383	0	11	0
	Bear Lake Inlet	4	127	1,555	0	5	0
2	Bear Lake Outlet	Not applicable, no outflow during winter					
	Paris Dike	3	259	23,739	0	42	0
	Above Alexander	7	403	7,262	0	16	0
3	Below Alexander	7	102	1,431	0	5	0
	Above Oneida	7	530	6,491	0	26	0
4	Below Oneida	6	559	6,840	0	31	0
	Idaho-Utah State Line	7	550	7,652	0	27	0

Table 28. Historic and current winter flow, TSS, and TP concentrations.

Management Reach	Site Description	Mean Flow cfs (SD)				TSS mg/L (SD)				TP mg/L (SD)			
		1974–2000	n	2006–2015	n	1974–2000	n	2006–2015	n	Mean (SD) 1974–2000	n	Mean (SD) 2006–2015	n
1	Idaho-Wyoming State Line	229 (123)	72	194 (139)	6	47 (96)	19	12 (6)	6	0.095 (0.179)	66	0.027 (0.009)	6
	Stewart Dam	281 (206)	21	206 (80)	7	21 (26)	15	8 (4)	7	0.034 (0.024)	21	0.021 (0.007)	7
	Bear Lake Inlet	27 (58)	10	127 (72)	4	10 (7)	10	5 (0)	4	0.053 (0.076)	10	0.016 (0.004)	4
2	Bear Lake Outlet	283 (175)	20	n/a		20 (32)	19	n/a		0.030 (0.028)	27	n/a	
	Paris Dike	570 (556)	24	362 (504)	3	17 (21)	19	8 (5)	3	0.028 (0.021)	24	0.025 (0.009)	3
	Above Alexander	149 (116)	3	403 (362)	7	3 (1)	3	8 (5)	7	0.013 (0.005)	3	0.017 (0.006)	7
3	Below Alexander	271 (154)	3	102 (37)	7	4 (1)	3	6 (2)	7	0.040 (0.003)	3	0.022 (0.006)	7
	Above Oneida	456 (117)	3	530 (387)	7	18 (6)	3	5 (0)	7	0.055 (0.013)	3	0.021 (0.007)	7
4	Below Oneida	448 (100)	11	559 (414)	6	6 (4)	11	5 (0)	6	0.037 (0.018)	11	0.027 (0.016)	6
	Idaho-Utah State Line	1061 (1067)	43	550 (389)	7	49 (143)	37	6 (2)	7	0.081 (0.065)	52	0.019 (0.005)	7



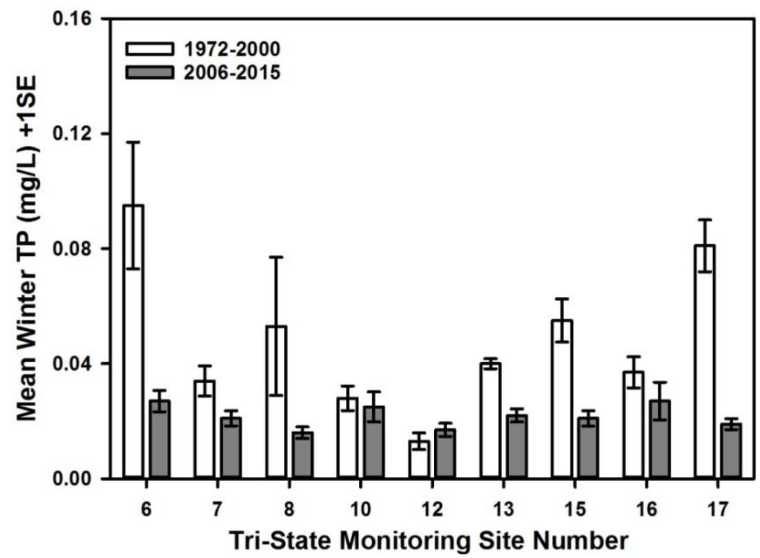


Figure 39. Historic and current TSS and TP concentrations in the Bear River in Idaho during winter base flow.

Table 29. Lower basin runoff loads (2006–2015).

Management Reach	Site Description	*n*	Mean Flow (cfs)	Mean TSS Load (kg/day)	Exceedances	Mean TP Load (kg/day)	Exceedances
1	Idaho-Wyoming State Line	9	434	99,712	2	32	2
	Stewart Dam	9	504	114,580	2	203	3
	Bear Lake Inlet	9	523	64,176	1	124	3
2	Bear Lake Outlet	n/a, no outflow during lower basin runoff					
	Paris Dike	4	78	4,985	0	23	1
	Above Alexander	9	350	26,682	1	62	2
3	Below Alexander	9	93	2,497	0	11	0
	Above Oneida	9	700	60,328	2	166	5
4	Below Oneida	9	728	11,080	0	94	3
	Idaho-Utah State Line	9	855	120,002	1	259	6

Table 30. Historic and current lower basin runoff flow, TSS, and TP concentrations.

Management Reach	Site Description	Mean Flow cfs (SD)				TSS mg/L (SD)				TP mg/L (SD)			
		1974–2000	n	2006–2015	n	1974–2000	n	2006–2015	n	1974–2000	n	2006–2015	n
1	Idaho-Wyoming State Line	624 (604)	51	434 (515)	9	158 (261)	16	55 (45)	9	0.119 (0.261)	46	0.110 (0.070)	9
	Stewart Dam	724 (542)	46	504 (566)	9	116 (115)	29	51 (45)	9	0.162 (0.135)	47	0.094 (0.076)	9
	Bear Lake Inlet	264 (226)	15	523 (606)	9	23 (37)	16	29 (34)	9	0.063 (0.066)	16	0.059 (0.062)	9
2	Bear Lake Outlet	381 (489)	47	n/a		20 (24)	28	n/a		0.059 (0.041)	52	n/a	
	Paris Dike	343 (413)	34	78 (145)	4	35 (23)	25	16 (10)	4	0.074 (0.042)	35	0.061 (0.047)	4
	Above Alexander	406 (246)	10	350 (195)	9	26 (22)	11	22 (25)	9	0.079 (0.042)	11	0.058 (0.043)	9
3	Below Alexander	515 (301)	10	93 (30)	9	15 (11)	11	11 (6)	9	0.058 (0.022)	11	0.050 (0.018)	9
	Above Oneida	778 (390)	10	700 (385)	9	37 (13)	11	29 (23)	9	0.110 (0.058)	11	0.085 (0.038)	9
4	Below Oneida	754 (342)	18	728 (373)	9	9 (4)	19	6 (3)	9	0.055 (0.014)	19	0.049 (0.013)	9
	Idaho-Utah State Line	1031 (954)	35	855 (392)	9	63 (68)	25	46 (40)	9	0.151 (0.153)	29	0.101 (0.065)	9

Table 31. Upper basin runoff loads (2006–2015).

Management Reach	Site Description	*n*	Mean Flow (cfs)	Mean TSS Load (kg/day)	Exceedances	Mean TP Load (kg/day)	Exceedances
1	Idaho-Wyoming State Line	10	851	151,654	3	283	3
	Stewart Dam	9	634	88,577	2	171	3
	Bear Lake Inlet	7	799	52,693	2	113	3
2	Bear Lake Outlet	3	711	13,166	0	29	0
	Paris Dike	5	259	56,748	0	42	1
	Above Alexander	10	636	89,825	3	159	3
3	Below Alexander	10	101	2,686	0	13	0
	Above Oneida	10	738	119,147	2	212	7
4	Below Oneida	10	753	10,634	0	76	2
	Idaho-Utah State Line	10	745	162,485	1	241	3

Table 32. Historic and current upper basin runoff flows, TSS, and TP concentrations.

Management Reach	Site Description	Mean Flow cfs (SD)				TSS mg/L (SD)				TP mg/L (SD)			
		1974-2000	n	2006–2015	n	1974–2000	n	2006–2015	n	1974–2000	n	2006–2015	n
1	Idaho-Wyoming State Line	1096 (1069)	73	851 (927)	10	97 (83)	25	78 (62)	10	0.179 (0.171)	70	0.135 (0.084)	10
	Stewart Dam	1252 (1047)	88	634 (950)	9	88 (60)	47	53 (41)	9	0.141 (0.088)	88	0.094 (0.054)	9
	Bear Lake Inlet	1008 (836)	39	799 (1067)	7	28 (19)	35	23 (19)	7	0.062 (0.024)	39	0.044 (0.020)	7
2	Bear Lake Outlet	549 (606)	86	711 (356)	3	23 (23)	55	7 (3)	3	0.063 (0.069)	101	0.016 (0.005)	3
	Paris Dike	603 (716)	74	259 (286)	5	49 (33)	55	26 (24)	5	0.083 (0.042)	73	0.049 (0.030)	5
	Above Alexander	816 (364)	14	636 (302)	10	56 (29)	14	44 (36)	10	0.112 (0.049)	14	0.082 (0.054)	10
3	Below Alexander	845 (393)	14	101 (41)	10	17 (8)	14	14 (8)	10	0.068 (0.017)	16	0.050 (0.015)	10
	Above Oneida	911 (419)	13	738 (389)	10	39 (7)	13	64 (82)	10	0.109 (0.030)	13	0.114 (0.079)	10
4	Below Oneida	810 (448)	23	753 (408)	10	9 (5)	23	6 (3)	10	0.052 (0.018)	23	0.039 (0.010)	10
	Idaho-Utah State Line	1514 (1437)	54	745 (551)	10	32 (24)	40	68 (136)	10	0.131 (0.224)	49	0.107 (0.140)	10

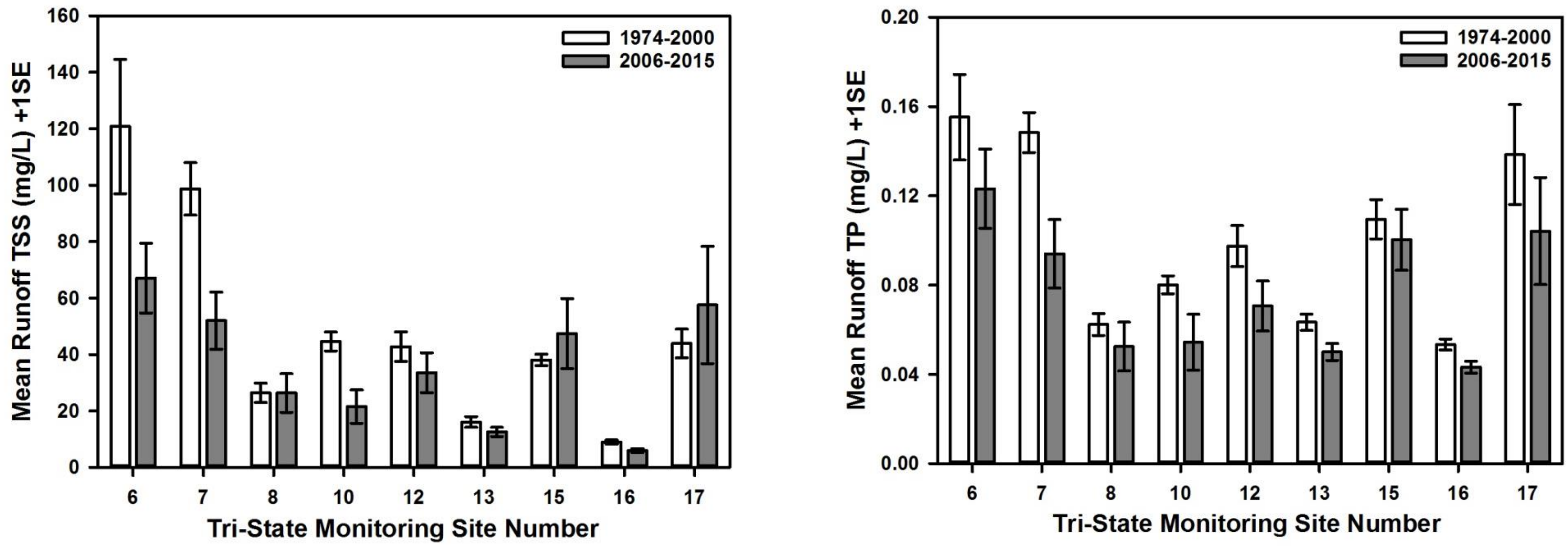


Figure 40. Historic and current TSS and TP concentrations in the Bear River in Idaho during runoff (both upper and lower basin).

Table 33. Summer loads (2006–2015).

Management Reach	Site Description	*n*	Mean Flow (cfs)	Mean TSS Load (kg/day)	Exceedances	Mean TP Load (kg/day)	Exceedances
1	Idaho-Wyoming State Line	10	175	6,416	0	17	2
	Stewart Dam	9	162	12,276	2	22	2
	Bear Lake Inlet			n/a, no inflow during summer			
2	Bear Lake Outlet	9	805	15,179	0	26	0
	Paris Dike	10	736	56,748	1	99	5
	Above Alexander	10	899	108,946	6	172	6
3	Below Alexander	10	117	5,250	0	17	0
	Above Oneida	10	937	62,630	4	161	7
4	Below Oneida	10	916	11,222	0	92	5
	Idaho-Utah State Line	10	646	43,222	1	86	4

Table 34. Historic and current summer flows, TSS, and TP concentrations.

Management Reach	Site Description	Mean Flow cfs (SD)				TSS mg/L (SD)				TP mg/L (SD)			
		1974–2000	*n*	2006–2015	*n*	1974–2000	*n*	2006–2015	*n*	1974–2000	*n*	2006–2015	*n*
1	Idaho-Wyoming State Line	242 (202)	72	175 (102)	10	96 (238)	23	13 (9)	10	0.107 (0.320)	65	0.034 (0.018)	10
	Stewart Dam	358 (287)	37	162 (120)	9	70 (58)	28	25 (17)	9	0.104 (0.083)	37	0.047 (0.030)	9
	Bear Lake Inlet	20 (42)	13	n/a		15 (10)	12	n/a		0.056 (0.057)	13	n/a	
2	Bear Lake Outlet	339 (359)	16	805 (392)	9	15 (18)	31	9 (6)	9	0.031 (0.054)	38	0.014 (0.004)	9
	Paris Dike	878 (582)	43	736 (406)	10	48 (32)	32	31 (21)	10	0.093 (0.135)	44	0.054 (0.033)	10
	Above Alexander	647 (325)	9	899 (433)	10	28 (24)	9	40 (27)	10	0.077 (0.056)	9	0.066 (0.037)	10
3	Below Alexander	711 (364)	9	117 (95)	10	15 (7)	14	17 (10)	10	0.065 (0.020)	14	0.054 (0.017)	10
	Above Oneida	737 (306)	9	937 (319)	10	31 (21)	9	25 (12)	10	0.085 (0.039)	9	0.065 (0.022)	10
4	Below Oneida	671 (310)	15	916 (328)	10	7 (2)	15	5 (0)	10	0.047 (0.024)	15	0.039 (0.014)	10
	Idaho-Utah State Line	983 (916)	50	646 (313)	10	34 (75)	37	22 (16)	10	0.071 (0.039)	47	0.047 (0.026)	10

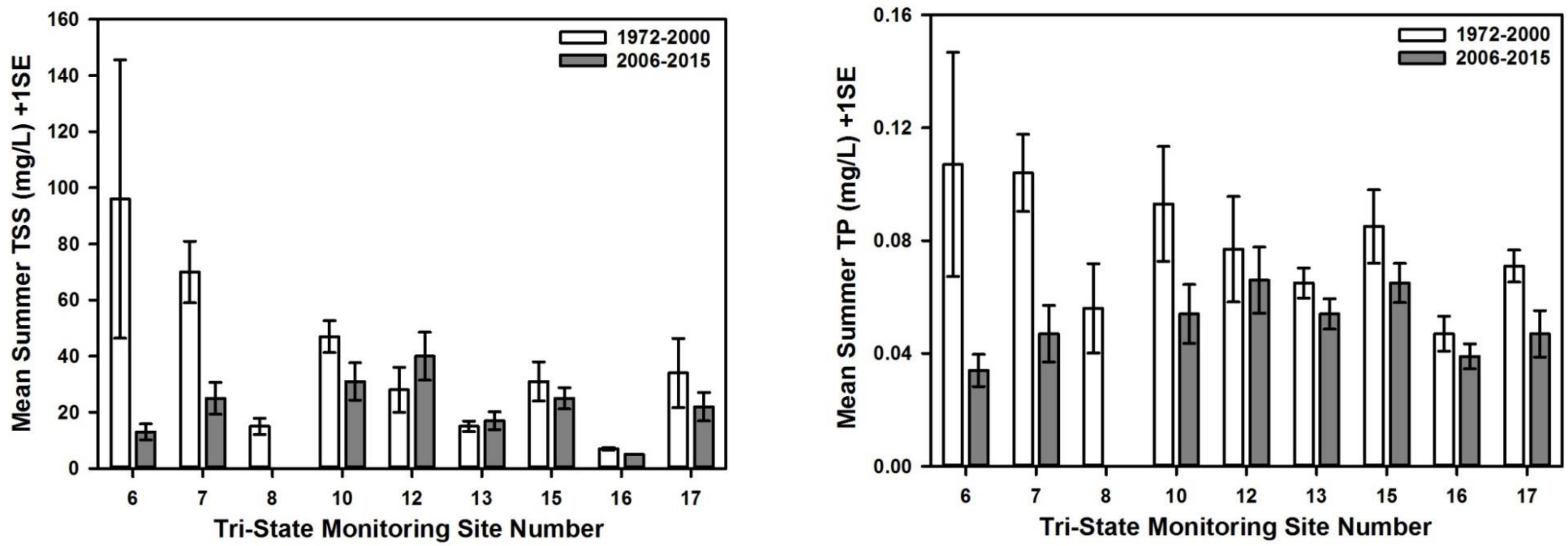


Figure 41. Historic and current TSS and TP concentrations in the Bear River in Idaho during summer.

3.3.5 Evaluation of the Bear River below Oneida Reservoir

The Bear River below Oneida Reservoir (ID16010202BR006_06) changes considerably as it flows south into Utah. DEQ samples the Bear River just downstream of Oneida Reservoir and the Bear River near the Idaho-Utah state Line. Water quality is substantially degraded from below Oneida Reservoir to the Idaho-Utah state line. During tri-state monitoring (2006–2015), exceedances of target TSS (80 mg/L runoff and 60 mg/L nonrunoff) and TP (0.075 mg/L) concentrations were never documented at the site below Oneida Reservoir. TP concentrations did, however, exceed 0.050 mg/L three times during lower basin runoff. At the Idaho-Utah state line, TP target concentrations (0.050 mg/L) were routinely exceeded during runoff and summer seasons. TSS targets were also commonly exceeded during runoff conditions.

Bank stability and habitat features also varied substantially in the river below Oneida Reservoir to the Idaho-Utah state line as documented in the 2015 Bear River Erosive Index study (3.3.2). In the approximately 5 miles from Highway 36 where the Bear River leaves the Oneida Narrows to the bridge at Highway 91 near Preston, bank stability is over 90%. As the river travels south towards Utah, uncovered and unstable banks increase. Between the tri-state monitoring site near the Idaho-Utah state line and the Highway 61 crossing near Cornish, Utah, unstable banks are present in 44% of images. The riparian community also transitions from a native willow/maple and cottonwood forest in the Oneida Narrows reach to a community dominated by invasive Russian olive trees and occasional tamarisk.

Fish communities in Oneida Reservoir and in the river below were sampled during 2008 and 2009 in preparation for generating an Environmental Impact Statement (EIS) for the Twin Lakes Canal Company's proposed Bear River Narrows Hydroelectric Project. In Oneida Reservoir, the fishery is primarily composed of nonnative species including Walleye, Common Carp, Smallmouth Bass, Yellow Perch, and Green Sunfish. Four out of five of the native fish species historically present have not been collected in the reservoir since 1987. The only remaining native fish present is the Utah Sucker, comprising <4% of the fish assemblage (Hardy et. al 2012).

The fishery below the reservoir was sampled at five reaches in 2009. Reaches were numbered from downstream to upstream. Reaches 5 and 4 were directly below the existing dam in the river reach known as the Oneida Narrows. Reach 3 encompasses the area near the confluence with Mink Creek where the river exits the Oneida Narrows Canyon. Reach 2 was just downstream of Riverdale and Highway 34. Reach 1 was the most downstream reach, between the Utah state-line and just below the Cub River pumps (Hardy et. al 2012).

Below the reservoir in Reach 4/5, Utah Suckers (35%), Rainbow Trout (31%), Smallmouth Bass (11.3%), Mountain White Fish (8.7%), Brown Trout (6.6%), and Common Carp (5.1%) composed most of the fish sampled. Two native species of concern, BCT and Bluehead Suckers, were present during all surveys but were in low abundance.

In Reach 3 just below the canyon, Utah Suckers (40.8%), Mountain White Fish (16.8%), Rainbow Trout (14%), Brown Trout (10.2%), Common Carp (9.6%), and Smallmouth Bass (5.9%) composed the majority of the fish assemblage.

Below Riverdale, the character of the fish community changes, with salmonid species becoming rare, and nonnative Common Carp dominating the fish community. In Reach 2, Utah Suckers and Common Carp were the two most common fish species in 2009. In Reach 1, no native species were collected during the 2009 sampling effort. Common Carp were observed in the highest densities in this reach, and Channel Catfish was the only other species collected.

Distribution of BCT is limited to Reaches 4/5 and 3. Below Riverdale, no Cutthroat Trout have been collected in the main stem Bear River during current or historical surveys, and no reproductive activity has been documented. Nonnative Brown Trout were historically stocked below Oneida Reservoir, but stocking ended in 1998. Brown Trout density and biomass are higher in Reach 4/5 and 3 than 2, and Brown Trout were absent in Reach 1. Successful reproduction of Brown Trout below Oneida Reservoir is indicated by the presence of juveniles. Rainbow Trout are currently stocked in the Bear River below Oneida Reservoir by the Idaho Department of Fish and Game to maintain a put-and-take fishery. Rainbow Trout were present in all river reaches, but densities are higher in Reach 3 and 4/5 than in Reach 2. Mountain White Fish have decreased in relative abundance over time. These fish were present in all river reaches except Reach 1, but density and biomass were lower in Reach 2 than in Reach 4/5. Mountain White Fish density and abundance was highest in Reach 3. Overall, both native (BCT and Mountain White Fish) and nonnative (Brown Trout and Rainbow Trout) salmonids are most abundant from below Oneida Reservoir to Riverdale. Below Riverdale, densities and relative abundance of salmonids precipitously decline.

Summer 2009 sampling results were compared to River Fish Index (RFI) scores as described in Idaho River Ecological Assessment Framework (Grafe et al. 2002) and using fish classifications from Zaroban et al. (1999) (Table 35). Only the first pass results were used to most closely represent methods used in developing the index scores. The RFI is composed of 11 metrics. With the available data, 9 metrics were available to generate a RFI score. The two metrics that could not be generated were number of coldwater fish captured per minute of electrofishing and percent anomalies. To normalize the scores to the 100 point scale, the sum of scores was multiplied by 11.1. Smaller fish were likely underrepresented in the boat electrofishing effort (Thompson and Rahel 1996). As a result, the number of sculpin age classes and the number of trout age classes may have been lower than the actual community assemblage. To account for this, we applied the mean length to the length at age table in the Idaho River Ecological Framework (Grafe et al. 2002) and assumed that all younger age classes were present. Rainbow Trout were excluded from calculations because they are annually stocked below Oneida Reservoir, and the assessment framework recommends that hatchery individuals be excluded from all counts (Grafe et al. 2002). Maret and Ott (2007) reported that a minimum reach length of 36 times the mean channel width is sufficient for estimating biotic conditions based on SFI scores. In this study, all reach lengths exceeded 36 times the mean channel width, with the shortest reach encompassing 2.2 miles of river.

In general, RFI scores declined as the river progressed downstream from the Oneida Narrows to the Idaho-Utah state line. Scores in Reach 4/5 and 3 were within 5 points of each other, indicating that differences in RFI scores are biologically insignificant. The standard deviation in metric scores used to develop the index was 5.6 (Grafe et al. 2002). RFI scores also did not significantly differ between Reach 1 and 2, but both scores were lower than in Reach 3 and 4/5. All SFI scores were below the minimum threshold score 54 indicating “waters with species composition, diversity, and functional organization dissimilar from natural habitats of the region" (Grafe et al. 2002). All reaches received scores indicating that fish communities were of low biological integrity, primarily driven by the dominance of nonnative species and the relative low numbers of native coldwater fish. Nonetheless, scores indicate that below Riverdale the character of the river changes and the fish assemblage is indicative of poor habitat and decreasing water quality.

Given differences in water quality, habitat characteristics, and fish assemblages, DEQ recommends that the AU ID16010202BR006_06 is divided into two separate AUs at the Highway 34 crossing at Riverdale. AU ID16010202BR006_06a should include the Bear River from Oneida Narrows Dam to Highway 34 at Riverdale. Above Riverdale salmonid spawning is an existing use, as evidenced by the presence of juvenile Brown Trout. Below Riverdale, Common Carp and tolerant taxa such as Utah Suckers dominate the fish community.

A biotelemetry study was conducted on trout (BCT and Rainbow and Brown Trout) in late 2008, throughout 2009, and during spring and early summer 2010 in the Bear River below Oneida Reservoir and in Mink Creek. In total, 75 salmonids were implanted with radio-tracking antennas (32 BCT, 30 Rainbow Trout, and 13 Brown Trout). BCT exhibited more movement seasonally than Rainbow and Brown Trout. In both 2009 and 2010, 8 BCT were tagged, and in both years, 3 exhibited substantially migratory movements to Mink Creek during April and May. These migratory fish tended to be some of the largest fish. Across all seasons, most BCT were located in runs (62%) but location varied seasonally. In winter, pools and backwater/eddy habitats were occupied more frequently than other seasons.

Rainbow and Brown Trout moved less seasonally and did not exhibit a seasonal migration to Mink Creek. Both Brown and Rainbow Trout, were most commonly located in runs throughout the year but tended to occur more often in pools and riffles during the winter. Most Brown Trout did not move between river reaches during the study and the majority of salmonids occurred in Reach 4/5.

In 2005, DEQ sampled macroinvertebrates at seven locations on the Bear River in Idaho and River Macroinvertebrate Index (RMI) scores were generated. Two sample locations occurred below Oneida Dam and both resulted in RMI scores of 3, indicating that communities were similar to those found under reference conditions. These data, however, are over 10 years old and were not part of a larger study that included other metrics (RFI, periphyton, and physiochemical) that could be used to make a beneficial use support status determination.

Table 35. River Fish Index scores for mark sampling conducted in summer 2009. Second pass information was not included to be comparable to River Beneficial Use Reconnaissance Program protocols. Rainbow trout were excluded from calculations because they are stocked.

Metric (x)	Metric score (y)	Metric by Reach				Metric Score by Reach			
		1	2	3	4/5	1	2	3	4/5
Coldwater native species[a]	$y = 0.33x$	0.00	1.00	2.00	3.00	0.00	0.33	0.67	1.00
Percent sculpin	$y = 0.0667x$	0.00	0.00	1.64	3.81	0.00	0.00	0.11	0.25
# sculpin age classes	# ages	0.00	0.00	4.00	3.00	0.00	0.00	0.93	0.75
Percent cold water[b]	$y = 0.0143x$	0.00	1.77	19.67	18.10	0.00	0.03	0.28	0.26
Percent sensitive native individuals[c]	$y = 0.014+0.039x-5.38E-4x^2+2.47E-6x3$	0.00	0.00	0.00	0.48	0.01	0.01	0.01	0.03
Percent tolerant individuals[d]	$y = (0.987-0.0065)/(1+(x/40.3)^{\wedge}7.23 + 0.0065)$	95.45	93.81	70.49	50.95	0.00	0.00	0.02	0.15
# nonindigenous species[e]	# species	3.00	4.00	3.00	3.00	0.06	0.00	0.06	0.06
# trout age classes	# ages	0.00	0.00	5.00	5.00	0.00	0.00	1.00	1.00
Percent carp	$y = e^{(-0.69x)}$	93.18	15.04	5.47	8.10	0.00	0.00	0.02	0.00
Adjusted RFI	Sum of metric scores × 11.1					0.9	4.2	34.4	39.0

a. Coldwater native species= Bonneville Cutthroat Trout, Mountain White Fish, and Mottled Sculpin
b. Coldwater species = Bonneville Cutthroat Trout, Mountain White Fish, Brown Trout, and Mottled Sculpin
c. Sensitive native individuals = Bonneville Cutthroat Trout
d. Tolerant taxa = Common Carp, Utah Suckers, and Channel Catfish
e. Nonindigenous species = Common Carp, Walleye, Channel Catfish, Brown Trout, and Smallmouth Bass.

3.3.6 Outside Studies of Water Quality in the Bear River

Black Canyon Boater Flow Effects Study

In 2008, PacifiCorp began a variable flow regime associated with whitewater releases at the Grace Hydropower Facility in a 6.2-mile reach of river known as the Black Canyon. PacifiCorp and the ECC developed a monitoring plan for this river reach to compare the aquatic biota and habitat before (2005–2007) and after (2008–2010) the start of the variable flow regime (Oasis Environmental 2011).

The study compared macroinvertebrate communities in a reference reach not impacted by the variable flow regime (Bear River above Alexander Reservoir) to macroinvertebrate communities at three locations within the Black Canyon where the variable flow regime was initiated (Figure 42). At the reference site, RMI scores varied by year, but scores were always above the intermediate macroinvertebrate community threshold. In the Bear River below Grace Dam, most macroinvertebrate scores indicated a macroinvertebrate community of poor biotic integrity (<14). For unknown reasons, the score in the last year of the study (2010), indicated an intermediate macroinvertebrate community. In the Middle Black Canyon, the habitat is a steeper-gradient riffle with cobble substrate that is unique to this river reach. Possibly resulting from this higher quality habitat, macroinvertebrate scores always indicated a community of moderate-to-good biotic integrity and did not tend to differ in response to the variable flow regime (Oasis Environmental 2011).

The flow in the lower reaches of the Black Canyon is augmented by several spring inputs. The macroinvertebrate community at the Lower Black Canyon access bridge is dominated by nonnative New Zealand mud snails. Before the variable flow regime began (2005–2007), RMI scores indicated poor biotic integrity. Following the first year of the variable flow regime, RMI scores tended to improve but still remained in the poor range. Improvement was likely related to high flow events temporarily depressing New Zealand mud snail numbers. In 2009 and 2010, however, scores declined as New Zealand mud snails recovered to previous levels (Oasis Environmental 2011).

Overall, initiation of the variable flow regime in the Black Canyon did not result in declining measures of biotic integrity in the macroinvertebrate community. While New Zealand mud snail numbers initially declined at the Lower Black Canyon access bridge following initiation of the variable flow regime, the snails recovered in subsequent years. Substrate surveys conducted during the same time period indicate that the variable flow regime corresponded with decreases in silt and sand and increased interstitial spaces in gravels and cobbles (Oasis Environmental 2011).

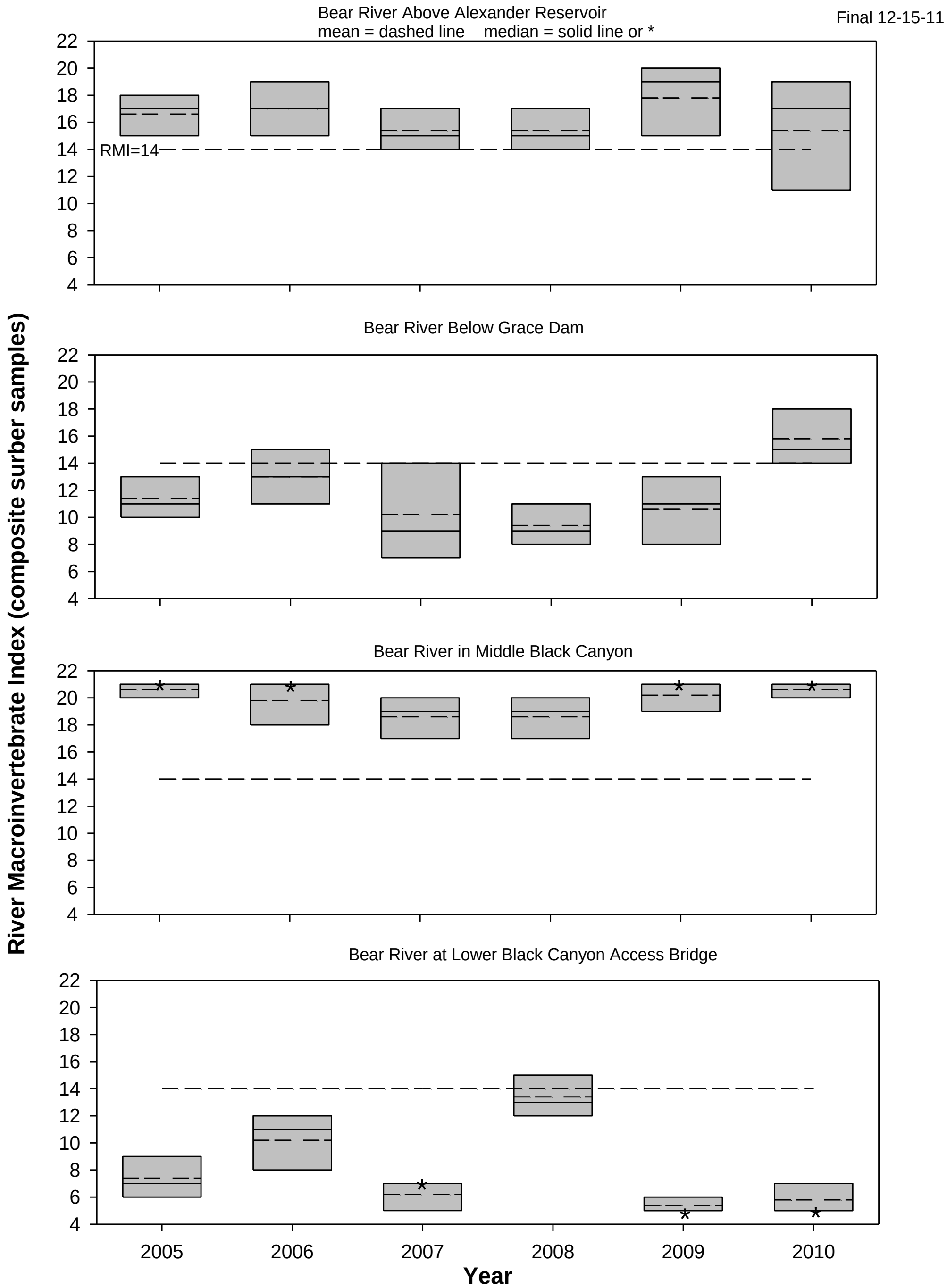


Figure 42. River Macroinvertebrate Index scores before and after initiation on a variable flow regime (2008) at one control (Bear River above Alexander Reservoir) and three affected sites on the Bear River in Idaho.

Study of Nutrient Limitation by Biofilms

The Center for Ecological Research and Education at Idaho State University conducted a study on nutrient limitation of biofilms in southeastern Idaho rivers in 2005 and 2006 with nutrient diffusing substrata. This study included two sites on the main stem Bear River in Idaho (one near

Dingle and one at the Idaho-Utah border, BR-17) and two sites on the Thomas Fork (upper and lower). Bioassays were conducted during four time periods: August and November 2005, and July and October/November 2006 (Marcarelli et al. 2008).

On the Thomas Fork of the Bear River, differences in nutrient limitation were observed between the lower site and the upper less-impacted study site. At the lower site, no responses to nutrients were observed on any of the four study dates. In contrast, at the upper site chlorophyll-*a* responded to nutrient additions on three study dates: significant nitrogen phosphorus colimitation on August 2005 and July 2006, and nitrogen alone stimulation on November 2006. Biomass at this site was significantly stimulated by nitrogen alone on two study dates: November 2005 and July 2006 (Table 36, Marcarelli et al. 2008).

On the Bear River main stem, nutrient limitation of chlorophyll-*a* and biomass was highly variable between sites, but frequent nutrient limitation was observed. At Dingle, a combination of nutrients primarily limited chlorophyll-*a*, while phosphorus primarily and nitrogen secondarily limited biomass in November 2005. In July 2006, nitrogen alone limited biomass. At the Idaho-Utah border, limitation of chlorophyll-*a* by nutrients was less frequent, but a combination of nutrients limited biomass (Table 36, Marcarelli et al. 2008).

Table 36. Chlorophyll-*a* and biomass (ash-free dry mass) responses to nutrient enrichments at each study site and date.[a]

Site	Limitation of Chlorophyll-*a*				Limitation of Biomass			
	Aug 2005	**Nov 2005**	**July 2006**	**Oct/Nov 2006**	**Aug 2005**	**Nov 2005**	**July 2006**	**Oct/Nov 2006**
Upper Thomas Fork	* **NP**	NS	*** **NP**	NS	NS	** **N**	** **N**	NS
Lower Thomas Fork	NS	NS	NS	NS	NS	NS	NS	NS
Bear River at Dingle	LOST	*** **1˚ P 2˚ N**	*** **1˚ N 2˚P**	*** **NP**	LOST	*** **1˚ P 2˚ N**	* **N**	NS
Bear River at ID-UT border	* **NP**	NS	NS	NS	* **NP**	* **P**	*** **NP**	* **1˚ N 2˚P**

a. The *indicates p = 0.01-0.05; ** indicates p = 0.001-0.01; *** indicates p < 0.001. Bold letters indicate the type of response, N = nitrogen, P = phosphorus, NP = nitrogen + phosphorus co-limitation, 1˚ = primary limitation, 2˚ = secondary response. NS indicates no significant response observed. LOST indicates that too many replicates were lost during the incubation period to determine significant effects (Marcarelli et al. 2008).

The results of this study indicate that nutrient limitation varies seasonally, and overall nutrient limitation may occur less frequently at sites with degraded water quality and higher background nutrients (Lower Thomas Fork and Bear River at Idaho-Utah border). The absence of nutrient limitation by biofilms may indicate that nutrients are already in excess and impacting beneficial uses.

Middle Bear Subbasin Water Quality Monitoring Report

In 2005 and 2006, the Idaho Association of Soil Conservation Districts (IASCD) conducted a study of water quality in the Middle Bear (HUC 16010202) subbasin in Idaho. Eight streams were monitored within the Franklin and Caribou Soil Conservation Districts' boundaries: Densmore (ID16010202BR013_02), Whiskey (ID16010202BR012_02), Williams

(ID16010202BR010_02), Cottonwood (ID16010202BR014_04), Battle (ID16010202BR015_04), Deep (ID16010202BR006_02a), Fivemile (ID16010202BR019_02a), and Weston Creeks (ID16010202BR020_04). IASCD collected water samples to be analyzed for suspended sediment concentration (SSC), TP, and nitrate + nitrite (N + N), twice monthly from March through September and once monthly during winter months. Flow and field parameters (temperature, dissolved oxygen, pH, and conductivity) were measured at each sampling event (Jenkins 2007a).

Williams and Cottonwood Creeks had the highest water quality and the lowest number of measurements that exceeded TMDL targets. Mean SSC concentrations exceeded TMDL targets (68 mg/L) at sites on Fivemile, Deep, Battle, Densmore, and Weston Creeks, and sediment loads were highest in Deep (84,751 lb/day), Fivemile (50,893 lb/day), and Battle (44,623 lb/day) Creeks. Patterns in TP were similar to patterns in sediment. Mean TP concentrations exceeded TMDL targets (0.075 mg/L) at sites on Fivemile, Deep, Battle, Densmore, Whiskey, and Weston Creeks. Similarly, TP loads were highest in Fivemile (49 lb/day), Deep (85 lb/day), and Battle (48 lb/day) Creeks (Jenkins 2007a).

Patterns in N + N differed from patterns in sediment and TP, reflecting ground water inputs, not erosion. Mean N + N concentrations were higher than 0.85 mg/L (the target in Thomas Fork) at site on Fivemile, Deep, Battle, Densmore, Whiskey, and Weston Creeks. Concentrations were greater than 3 × 0.85 mg/L in Whiskey and Weston Creeks, and N + N loads were highest in Whiskey (267 lb/day), Weston (214 lb/day), and Deep (164 lb/day) Creeks. Nitrates may be high in ground water due to agricultural practices and septic tanks (Jenkins 2007a).

Little Malad Subbasin Water Quality Monitoring Report

In March 2005 through November 2006, IASCD conducted a study of water quality in the Little Malad subbasin, part of the Lower Bear/Malad subbasin (HUC 16010204) in Idaho. Eight sites were monitored including three on Wright Creek (ID16010204BR010_03 and ID16010204BR010_04), an additional site each of Indian Mill (ID16010204BR010_02a), Dairy (ID16010204BR011_03), Little Malad River (ID16010204BR009_02), Hill (ID16010204BR009_02), and Elkhorn (ID16010204BR008_02a) Creeks. All of the monitoring sites, except Elkhorn Creek, drain into Daniels Reservoir. Measurements were conducted twice monthly from March through November and were the same as in the Middle Bear subbasin (Jenkins 2007b).

Most monitoring locations experience peak flows in the spring and then subsided as the summer and fall progressed. Little Malad River, meanwhile, remained at a relatively constant flow throughout the monitoring period. All monitoring sites, except Little Malad River and Dairy Creek, had mean sediment concentrations in excess of TMDL targets. Highest concentrations occurred at Hill Creek (190 mg/L) and Lower Wright Creek (126 mg/L). Lower Wright Creek exported the highest amount of sediment to Daniels Reservoir (4,873 lb/day). Mean TP concentrations exceeded the TMDL target of 0.075 mg/L at all sites except Little Malad River. Mean N + N concentrations were over 0.85 mg/L in Elkhorn and Hill Creeks and Little Malad River (Jenkins 2007b).

Overall, Hill Creek had the poorest water quality followed by Wright Creek. BMPs such as sediment basins had exceeded their lifespan and were no longer functioning in the Hill Creek watershed at the time of the report. The report recommended that sediment basins be emptied and repaired and riparian buffers be enlarged to improve water quality. The report identified mining activities and agriculture as negatively impacting water quality in the Wright Creek watershed. Recommendations for improvement included modifying sediment basins and altering road maintenance practices in mining areas and installing BMPs (use exclusion, riparian buffer, filter strips, tree/scrub planting, and prescribed grazing) on degraded reaches of agricultural land below the mining impacts.

3.4 Beneficial Use Recommendations

The Bear River basin in Idaho, including the Central Bear, Bear Lake, Middle Bear, and Malad HUCs, contains 242 AUs. Only 34 AUs are currently fully supporting beneficial uses according to the 2012 Integrated Report (DEQ 2014a). Seventy-three AUs are in Category 3 as unassessed and 135 are not supporting beneficial uses (Figure 43). AUs supporting beneficial uses account for 14% of AUs in the watershed, below the state average of 25%. Unassessed AUs account for 30% of AUs in the Bear River subbasin, slightly below the statewide average of 34%. Many of the unassessed AUs are 2nd-order streams that are likely too small (either naturally or because of water withdrawals) to be assessed with BURP protocols. Several unassessed AUs are also small irrigation reservoirs that are typically not included in sampling efforts. Two previously unassessed AUs (Upper Pearl Creek ID16010201BR005_02b and Georgetown Creek ID16010201BR022_03) were surveyed by BURP in 2012 and 2013, respectively, and will be assessed in the next Integrated Report.

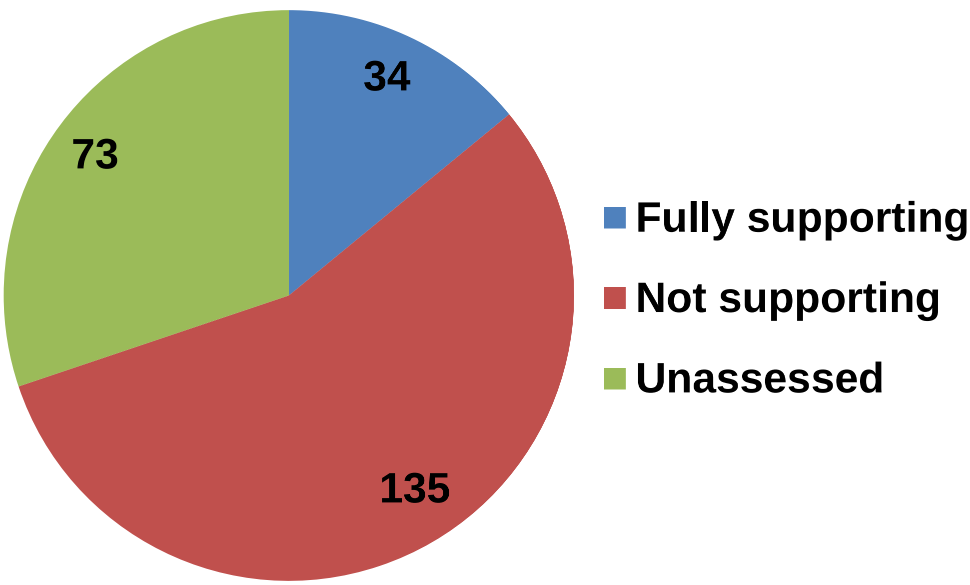


Figure 43. Status from 2012 Integrated Report of 242 AUs in Bear River subbasin.

As part of this 5-year review, AUs included in the Bear River TMDL (DEQ 2006a) were evaluated to assess whether they are currently supporting beneficial uses. First, BURP data were reviewed as explained in section 3.3.1. If condition ratings indicated that cold water aquatic life was being supported, recent water quality data were evaluated. If water quality data indicated that TMDL targets were being met and BURP data confirmed that cold water aquatic life was currently being supported, an AU was recommended for delisting as presented in section 5.3, Table 46.

4 Review of Implementation Plan and Activities

An implementation plan for the 2006 TMDL was completed for USFS lands by the Caribou-Targhee National Forest. The Idaho Soil Conservation Commission (ISCC) and IASCD worked with local conservation districts and the United States Department of Agriculture Natural Resources Conservation Service (NRCS) to complete agricultural implementation plans for the various regions within the Bear River and Malad River basins in Idaho. Implementation plans are discussed below.

4.1 Bear River Basin

In 2008, the Caribou-Targhee National Forest and the Curlew National Grassland completed a TMDL implementation plan for lands in the Bear River Basin under the jurisdiction of the USFS (*http://www.deq.idaho.gov/media/449964-bear_river_imp_plan.pdf*). This plan summarized forest-wide documents that provide specific management direction for USFS lands contained in the Bear River and Malad River subbasins in Idaho. The plan also reviewed prioritizing implementation for streams in the 2006 TMDL and accomplished and planned activities. Implementation strategies for a majority of streams focused on improving livestock grazing with site-specific BMP design, implementation, and monitoring of their effectiveness (Higginson 2008).

4.2 Central Bear Subbasin

In 2008, the ISCC and IASCD in cooperation with the Bear Lake Soil and Water Conservation District (SWCD) and NRCS completed an agricultural implementation plan for the Bear River main stem in the Central Bear subbasin (HUC 16010102 *https://www.deq.idaho.gov/media/449961-bear_lake_ag_imp_plan.pdf*). The objectives of the plan were to identify critical areas and to recommend BMPs through on farm conservation plans with individual landowners. In the Central Bear subbasin, 58% of the land is private and 36% is controlled by the Bureau of Land Management (BLM). Most of the land bordering the river is privately held. Of the private land in the subbasin, 72% is rangeland, and 24% is cropland. Due to the short growing season, the majority of crops are alfalfa and small grains. BMPs on cropland should focus on areas that exceed tolerable soil loss. On rangelands, the most common water quality problem is the lack of proper distribution of livestock partially due to the lack of livestock watering facilities (ISCC and IASCD 2008a).

The plan listed BMPs and estimated costs for four treatment units: riparian areas, croplands, rangelands, and animal facility waste management. The plan presented implementation alternatives and the Bear Lake SWCD chose to focus on land treatment with structural and nonstructural BMPs, riparian and stream channel restoration, and animal facility waste management. An estimated timeline for agricultural implementation was presented and funding sources were identified (Table 37) (ISCC and IASCD 2008a).

Table 37. Estimated timeline for TMDL agricultural implementation in the Central Bear subbasin (ISCC and IASCD 2008a).

Task	Output	Milestone
Develop conservation plans and contracts	Completed contract agreements	2013
Finalize BMP design	Completed BMP plans and designs	2016
Design and install approved BMPs	Certify BMP installation	2022
Track BMP effectiveness	Implementation progress report	2023
Evaluate BMP and project effectiveness	Complete project effectiveness report	2025

4.3 Bear Lake Subbasin

In 2008, the ISCC and IASCD in cooperation with the Bear Lake SWCD and the Caribou Soil Conservation District completed the Bear Lake Subbasin TMDL Implementation Plan for Agriculture (*https://www.deq.idaho.gov/media/449961-bear_lake_ag_imp_plan.pdf)*. The objective of the plan was to reduce the amount of sediment, phosphorus, and nitrogen entering both the surface and ground water from agricultural-related practices. Private cropland, primarily alfalfa and wild meadow hay, account for 27% of the subbasin, and private rangeland accounts for 21%. At the time the implementation plan was completed, there were 15 dairies and 35 feedlots in the subbasin. The plan listed recommended BMPs and estimated costs for stream channels and riparian areas, croplands, rangelands, and animal facilities (treatment units 1 through 4, respectively). The Bear Lake SWCD decided to focus on improving rangeland conditions while the Caribou Soil Conservation District decided to focus on improving dry cropland. An estimated timeline for TMDL agricultural implementation was presented (Table 38), and funding sources were identified (ISCC and IASCD 2008b).

Table 38. Estimated timeline for TMDL agricultural implementation in the Bear Lake subbasin (ISCC and IASCD 2008b).

Task	Output	Milestone
Develop conservation plans and contracts	Completed contract agreements	2010
Finalize BMP design	Completed BMP plans and designs	2015
Design and install approved BMPs	Certify BMP installation	2018
Track BMP effectiveness	Implementation progress report	2022
Evaluate BMP and project effectiveness	Complete project effectiveness report	2025

4.4 Middle Bear Subbasin

The Middle Bear subbasin was the focus of three implementation plans for agriculture, the Northern Middle Bear, Cub River, and Southern Middle Bear. The Northern Middle Bear River TMDL Implementation Plan for Agriculture includes the water bodies between Alexander and Oneida Reservoirs in the Middle Bear subbasin. The plan was completed by the ISCC and IASCD in cooperation with the Franklin SWCD and NRCS in September 2008 (*https://www.deq.idaho.gov/media/449955-northern_middle_bear_ag_imp_plan.pdf)*.

Private land accounts for 58% of the Northern Middle Bear subbasin. Of the 125,848 acres of private land, 27% is irrigated cropland, 21% is dry cropland, and 45% is rangeland. The implementation plan identified lack of proper distribution of livestock grazing and the lack of livestock watering facilities as the most common riparian problem in the subbasin. At the time the implementation plan was completed, there were four dairies and one feedlot in the subbasin. The plan listed recommended BMPs and estimated costs for stream channels and riparian areas, croplands, rangelands, and animal facilities (treatment units 1 through 4, respectively). The Caribou Soil Conservation District and Franklin SWCD determined that riparian and stream channel restoration was their primary focus in the subbasin followed by animal facilities/waste management, land treatment with structural and nonstructural BMPs on cropland and rangelands, and land treatment with nonstructural BMPs in that order. An estimated timeline for TMDL agricultural implementation (Table 39) was presented and funding sources were identified (ISCC and IASCD 2008c).

Table 39. Estimated timeline for TMDL agricultural implementation in the Northern Middle Bear subbasin (ISCC and IASCD 2008c).

Task	Output	Milestone
Develop conservation plans and contracts	Completed contract agreements	2012
Finalize BMP design	Completed BMP plans and designs	2015
Design and install approved BMPs	Certify BMP installation	2018
Track BMP effectiveness	Implementation progress report	2022
Evaluate BMP and project effectiveness	Complete project effectiveness report	2025

The Cub River Watershed Agricultural TMDL Implementation Plan was completed in 2006 by the ISCC in cooperation with the IASCD, Franklin SWCD and NRCS. The plan focuses on recommending BMPs that would improve the physical and biological functions of the Cub River, Worm Creek, and Maple Creek in Idaho (*http://bearriverinfo.org/files/publications/publication/pub__1523243.pdf)*.

Private land accounts for 46,294 acres and 56.2% of the Cub River watershed. Of the private land in the subbasin, cropland accounts for 51.2%, and rangeland accounts for 42.0%. At the time the implementation plan was completed, there were 24 total animal facilities in the subbasin. Three implementation tiers were identified in the subbasin including tier 1: unstable and erosive stream channels and riparian areas or adjacent fields and facilities that have a direct and substantial negative influence on the stream; tier 2: fields or facilities with an indirect, yet substantial negative influence on the stream; and tier 3: upland areas or facilities that indirectly influence the stream. BMPs were identified for four treatment units: stream channels and riparian, croplands, rangelands, and animal facilities. The Franklin SWCD selected land treatment with structural and nonstructural BMPs on crop and rangelands as their first priority, riparian and stream channel restoration as their second priority, and animal facilities as their third priority. An estimated timeline (Table 40) was presented and funding sources were identified (ISCC 2006).

Table 40. Estimated timeline for TMDL agricultural implementation in the Cub River watershed (ISCC 2006).

Task	Output	Milestone
Develop conservation plans and contracts	Completed contract agreements	2011
Finalize BMP design	Completed BMP plans and designs	2013
Design and install approved BMPs	Certify BMP installation	2019
Track BMP effectiveness	Implementation progress report	2020
Evaluate BMP and project effectiveness	Complete project effectiveness report	2025

The Southern Middle Bear Subbasin TMDL Implementation Plan (*https://www.deq.idaho.gov/media/449958-southern_middle_bear_ag_imp_plan.pdf*) recommended BMPs that would improve physical and biological function in the Bear River and Weston, Deep, Battle, Strawberry, and Fivemile Creeks. The plan was completed in 2008 by the ISCC in cooperation with the Franklin SWCD, IASCD, and NRCS (ISCC 2008).

In the Southern Middle Bear subbasin, private land accounts for 75% of the land. Irrigated cropland covers 66,544 acres or 30.4% of the private land. Dry cropland covers 51,534 acres of 23.5% of private land, and rangeland accounts for 90,422 acres and 41.3% of private land. At the time the implementation plan was completed, there were 22 animal facilities in the subbasin. The Franklin SWCD selected land treatment with structural and nonstructural BMPs on crop and rangelands as their first priority, riparian and stream channel restoration as their second priority, and animal facilities waste management as their third priority. An estimated timeline was presented and funding sources were identified (Table 41) (ISCC 2008).

Table 41. Estimated timeline for TMDL agricultural implementation in the Southern Middle Bear subbasin (ISCC 2008).

Task	Output	Milestone
Develop conservation plans and contracts	Completed contract agreements	2013
Finalize BMP design	Completed BMP plans and designs	2016
Design and install approved BMPs	Certify BMP installation	2022
Track BMP effectiveness	Implementation progress report	2023
Evaluate BMP and project effectiveness	Complete project effectiveness report	2025

4.5 Malad Subbasin

In the Lower Bear/Malad subbasin, an agricultural implementation plan was developed for water bodies above Daniels Reservoir in the Daniels watershed (*https://www.deq.idaho.gov/media/449967-daniels_watershed_ag_imp_plan.pdf*) by the ISCC and IASCD in cooperation with the Oneida SWCD and NRCS. The objective of the plan was to identify critical areas and to recommend BMPs for reducing sediment load to receiving water bodies.

In the Daniels subwatershed, 65% of the land is private. Nonirrigated hay, pasture, and cropland accounts for 27,958 acres or 64% of the private land. Rangeland accounts for 14,512 acres or 34% of private land. The Oneida SWCD identified streambank modifications, overutilized pastures, sheet and rill erosion, classic and gully erosion, and streambank erosion as problems in the watershed. Critical areas for agricultural implementation were identified including stream corridor and riparian areas, nonirrigated crop and pasturelands, rangelands, and animal facilities. BMPs were identified for each critical area, and funding sources for BMP implementation were presented. The Oneida SWCD selected land treatment with structural and nonstructural BMPs for hay, crop, and pastureland, riparian and stream channel restoration, and animal facility waste management as their preferred alternatives for TMDL implementation in the Daniels watershed. An estimated timeline for agricultural implementation was presented (Table 42) (ISCC and IASCD 2007).

Table 42. Estimated timeline for TMDL agricultural implementation in the Daniels watershed (ISCC and IASCD 2007).

Task	Output	Milestone
Develop conservation plans and contracts	Completed contract agreements	2010
Finalize BMP design	Completed BMP plans and designs	2015
Design and install approved BMPs	Certify BMP installation	2018
Track BMP effectiveness	Implementation progress report	2022
Evaluate BMP and project effectiveness	Complete project effectiveness report	2025

An agricultural implementation plan was developed for the area of the Lower Bear/Malad subbasin between Daniels Reservoir and the Utah state line in 2010 (*http://www.deq.idaho.gov/media/449898-lower_bear_malad_subbasin_ag_imp_plan.pdf*). The plan was developed by the ISCC in cooperation with the Oneida SWCD and NRCS. The objectives of the plan were to identify critical areas along the listed stream segments and recommend BMPs for reducing sediment and nutrient load to Deep Creek, Devil Creek, Elkhorn Creek, Little Malad River, Malad River, and Samaria Creek (ISCC 2010).

Irrigated and dry cropland account for 23.8% and 32.2% of private land use in the subbasin, while rangeland accounts for an additional 39.2% of private land. The Oneida SWCD identified streambank modifications, confined animal feeding operations, overutilized pastures, freeze/thaw cycles of streambanks, sheet and rill erosion, classic and ephemeral gully erosion, irrigation induced erosion, and streambank erosion as problems in the basin. Field inventories identified 24 animal facilities in the subbasin that had negative influence on streams because there were no off-channel water sources and insufficient waste storage structures to contain corral or site runoff. Critical areas for agricultural implementation were divided into tiers in order of priority for BMP implementation. Tier 1 was identified as unstable and erosive stream channels and riparian areas or adjacent fields and facilities that have a direct and substantial negative influence on the stream. Tier 2 included fields or facilities with an indirect, yet substantial influence on the stream, and tier 3 was upland areas or facilities that indirectly influence the stream. BMPs were identified for each critical area, and funding sources for BMP implementation were presented. The Oneida SWCD selected land treatment with structural and nonstructural BMPs on crop and rangelands, riparian and stream channel restoration, and animal facility waste management as their preferred alternatives for TMDL implementation in the Malad watershed. An estimated timeline for agricultural implementation was presented (Table 43) and available funding sources were identified (ISCC 2010).

Table 43. Estimated timeline or TMDL agricultural implementation in the Malad watershed (ISCC 2010).

Task	Output	Milestone
Develop conservation plans and contracts	Completed contract agreements	2013
Finalize BMP design	Completed BMP plans and designs	2016
Design and install approved BMPs	Certify BMP installation	2022
Track BMP effectiveness	Implementation progress report	2023
Evaluate BMP and project effectiveness	Complete project effectiveness report	2025

4.6 Responsible Parties

Table 44 outlines the federal, state, and local governments, individuals, or entities that are involved in or responsible for implementing the Bear River subbasin TMDL (DEQ 2006a).

Table 44. Designated management agencies and their responsibility for implementing the Bear River subbasin TMDL.

Designated Management Agency	Resource Responsibility
Idaho Soil and Water Conservation Commission	Agriculture
Bureau of Land Management	BLM Land
Caribou-Targhee National Forest	USFS Land
Idaho Department of Lands	State endowment lands, timber harvest, and mining
Idaho Department of Transportation	Roads

4.7 Accomplished and Planned Activities

PacifiCorp's Environmental Coordination Committee

The Federal Energy Regulatory Commission approved a Settlement Agreement in 2003 relicensing the Bear River Project for 30 years. The ECC is a stakeholder group of signatories to the agreement that consults and decides on the use of funding and other license requirements of the Bear River Project (PacifiCorp 2015). Each year the ECC generates a report detailing funded projects. These projects are described below.

2007 Annual Report

In 2007, ten habitat enhancement projects were funded: Laurie Harris Spring Complex Protection; Fish Screen on Hoop Creek; Trout Creek Vegetation Restoration Plan; Whiskey Creek and Trout Creek Reclamation; Bunderson Riparian Protection on Paris Creek; Mathews Bear River Restoration; Georgetown Hydro Fish Passage; Eightmile Road and Trail Closure; Midland Trail Renovation; and North Canyon Riparian Protection. Additionally, conservation easements in the Grace-Cove Reach were completed. Studies on BCT were completed including thermal imaging of the river and a genetics study (PacifiCorp 2007).

2008 Annual Report

In 2008, PacifiCorp completed the Comprehensive Bonneville Cutthroat Trout Restoration Plan in consultation with ECC. Eight habitat enhancement projects were funded: additional funding approved for Harris Spring Complex Protection; Cub River Irrigation Diversion Upper; Panther/Ames and Harris Ditch Diversion; Black Canyon Turner Bridge Clean Up; Creek Road Culvert in Bailey Creek; Old Oregon Trail Road Culvert in Bailey Creek; Stauffer Creek Riparian Protection; and Screen Tender Funding. In the Land and Water Conservation Fund, the Sagebrush Steppe Regional Land Trust closed a 214-acre conservation easement on the Bear River below the Oneida Project and funding for an addition to the Georgetown Summit Wildlife Management Area was approved. Matching funding was approved for a full-time position at the Sagebrush Steppe Regional Land Trust. Additionally, in 2008 whitewater boater flow release gates were installed on the Grace Dam and boater flow releases began. DEQ monitored water quality associated with boater flow releases through the Black Canyon (PacifiCorp 2008).

2009 Annual Report

In 2009, Idaho Department of Fish and Game (IDFG) completed the Bonneville Cutthroat Trout Telemetry Study and received brood stock development funds. Nine habitat enhancement projects were funded including: Kackley Springs Flow Reroute; Cub River Upper Diversion; Aquatic Nuisance Species Signage; Keetch Fish Screen/Water Control; Bailey Creek Headwater Springs Fence; Battle and Mink Creek Corrals; Anderson 8-Mile Creek Irrigation Upgrade; Repair Ovid Creek and Cub Creek Screens; and Conceptual Design for Fish Passage at Oneida Narrows Dam. Land and Water Conservation Fund accomplishments included a 116-acre conservation easement closed by the Sagebrush Steppe Regional Land Trust on the Bear River below the Grace Project. Funding for a conservation easement on Deep Creek in Franklin County was also approved. Boater flows were carried out, and monitoring was completed by DEQ (PacifiCorp 2009).

2010 Annual Report

In 2010, the final brood stock development funding payment was made to IDFG. Twelve habitat enhancement projects were funded: Alleman Dam Removal; Bunderson; Roy Fish Passage and Screen; Bunderson; Max Fish Ladder; Whiskey Creek Restoration; Georgetown Fish Ladder; Screen Tender; Oneida Narrows Riparian Protection; Alexander Shrub Planting; Cub River Fish Tracking; Kackley Springs Fish Trap/Barrier; Kackley Springs Consultation; Cub and Cottonwood Creek Fish Screen Maintenance. The Sagebrush Steppe Regional Land Trust closed a 433-acre land purchase in Franklin County. Boater flows were carried out, and monitoring was completed by DEQ. The Grace and Last Chance Site Plan was finalized in 2010, and implementation activities were completed, which included excluding cattle and reseeding areas with native grasses (PacifiCorp 2010).

2011 Annual Report

In 2011, a draft Conservation Hatchery Agreement was prepared by IDFG, and IDFG released the first BCT produced at their hatchery to Kackley Springs. Nine habitat enhancement projects were funded: Cub River Fish Ladder Improvements; Fox/North Hoops Creek Fish Screen; Screen Tender 2011; Bear River Tributary Sediment Removal; Bonneville Cutthroat Trout 10-

Year Return Monitoring; Tingey/Trout Creek Corral Relocation; Phase 1, Laurie Harris Spring-Repairs to Alternative Water Source; Cottonwood Creek Fish Screen Design; and Nichols/Whiskey Creek Stream Restoration. Boater flows continued (PacifiCorp 2011).

2012 Annual Report

In 2012, IDFG released 8,000 BCT to the Bear River. Thirteen habitat enhancement projects were approved and funded: Cottonwood Creek Fish Screens; Fish Screen Tender; Gentile Canal Entrainment Study; Hansen Fencing; Harris Spring Restoration and Repair; Ovid Creek Corral Relocation; Sediment Removal on Spring and Stauffer Creeks; Smith Bear River Fencing and Alternative Water Source; Stauffer and Spring Creek Fencing; Kackley Springs Dike Repair; Black Canyon Dump Cleanup; Trout Creek Restoration; Kackley (Trust Property) Seeding and Set Aside Maintenance/Overruns. Additionally, a 1,033 acre conservation easement was closed on Mink Creek. Water quality monitoring during boater flows continued to inform potential future management decisions (PacifiCorp 2012).

2013 Annual Report

In 2013, IDFG released 19,544 BCT that were raised in 2013. Eight habitat enhancement projects were funded: Pearl Creek Reconnect; Fish Screen Repair Fund; Fish Screen Tender; Dead Horse Spring Restoration; Smith Bear River Fencing; BCT Trapping on Stauffer and Georgetown Creeks; Cove Spring Reconnection; and Keetch Livestock Waste Containment. A total of nine boater flow releases were made on four weekends in 2013 (PacifiCorp 2013).

2014 Annual Report

In 2014, IDFG released 13,522 BCT in the spring and an additional 14,102 in the fall. Ten habitat enhancement projects were funded: Bonneville Cutthroat Trout Brood Stock Ponds; Co-Op Creek Crossing and Trail Improvements; Cottonwood Creek Screen Completion; Fish Screen Tended 2014; Fox-North Hoops Creek Fish Screen Replacement; Grace-Cove Spring Projects; Harris Spring Renovation; Oneida Narrows Boater Take-Out; Stauffer Culvert Replacement; and Sweer Bear River Fencing. One conservation property transaction was completed. Nine boater flow releases were made on four weekends in 2014 (PacifiCorp 2014).

The majority of PacifiCorp's habitat enhancement projects will help achieve TMDL targets. Many projects focus on sediment and nutrient reductions and take place on TMDL streams and all drain to the main stem Bear River, a TMDL water body. Efforts to recover BCT will ultimately lead to improving BURP scores through higher Stream Fish Index ratings. Additionally, projects aimed at improving fish passage often have additional benefits such as helping move streams towards appropriate sediment transport regimes and maintaining channel stability.

Bear River §319 Subgrants

To document §319 projects in the Bear River Basin that have taken place since the approval of the 2006 TMDL, the Nonpoint Source Management Program's Performance and Progress Reports were reviewed from 2007 to 2014.

Bear River §319 Subgrants in 2007 Evaluation Reports

Subgrant agreement S151, Bear River Stream Bank Restoration at Martin Mast Property, involved installing an estimated 500 feet of rock armor, 240 feet of rip-rap, and 140 feet of willow plantings along the Bear River above the Bear Lake Inlet Canal. The landowner also received continuous Conservation Reserve Program status for the adjacent grazing land to reduce erosion associated with grazing.

Subgrant agreement S171, Bear River AFO Relocation, involved moving livestock facilities away from tributaries to the Bear River in the Middle Bear subbasin. The evaluation was cancelled because no work was accomplished towards this goal, and the project had fallen behind schedule.

Subgrant agreement S189, St. Charles Creek Watershed Restoration, involved reducing cattle manure release to the lower forks of St. Charles Creek that are used as winter feeding areas for cattle and are irrigated in the spring and fall. At the time of the report, the project was delayed due to landowner issues, and work was planned for a different landowner's property using similar BMPs.

Subgrant agreement S190, Bear Ridge River Dingle AFO, planned to exclude cattle from riparian areas of Paris Creek, develop off-channel watering, install corral berms, and plant riparian vegetation. The project was on schedule with an anticipated completion date of August 31, 2008.

Subgrant agreement S191, Deep Creek/Bear River Management, planned to exclude cattle from riparian areas and revegetate and stabilize channels. Adjacent agricultural uplands would be treated with irrigation management, prescribed grazing, and pest management. This project was in the planning stages with an anticipated completion date of August 31, 2008 (DEQ 2008).

Bear River §319 Subgrants in 2008 Evaluation Reports

Subbasin agreement S221, Bear River Basin Water Quality Improvement, installed riparian fencing, improved existing watering facilities, and developed new springs and wells for off-site watering. These efforts provided better riparian management and intended to improve water quality in Pegram, Densmore, and Jenkins Creeks in the Bear River basin.

Bear River §319 Subgrants in 2009 Evaluation Reports

Subgrant agreement S190, Bear River Dingle AFO, was reevaluated in the 2009 Performance and Progress Report. This project intended to reduce cattle-related nutrient and bacteria inputs to the Bear River by establishing a riparian buffer, exclusionary fencing, corrals, a covered calving barn and feeding facility, pipelines, and numerous watering troughs. This project was completed in December 2008.

Subgrant agreement, S189, St. Charles Creek Watershed Restoration, was reevaluated in the 2009 report. This project took place along Paris Creek and involved screening irrigation diversions, excluding cattle from riparian areas, and installing water gaps. This project's anticipated completion date was December 2009.

Subgrant agreement S207, Thomas Fork Stream Bank Stabilization Project, took place on Lou Hillier's property. This project reshaped streambanks and planted riparian buffers along a 4,200-foot section of the Thomas Fork to reduce sediment and nutrient load to the creek and the Bear River. The project was ahead of schedule with an anticipated completion date of midsummer 2010.

Subgrant agreement S208, Thomas Fork Stream Bank Stabilization, took place on the Boehme property. This project included bank shaping along 3,200 linear feet of degrading streambank, riprap placement, bank barbs, and willow plantings and wattles. This project was also ahead of schedule and was to be completed during the summer 2010.

Subgrant agreement S296, Bear River AFO, Mid Bear Subbasin, planned to relocate or alter six AFOs that had direct contact with waters in the Middle Bear subbasin (HUC 16010202). This project was originally agreement S171 but was cancelled because of delays and was given a new agreement. The project was on track to be completed by December 31, 2009 (DEQ 2009).

Bear River §319 Subgrants in 2010 Evaluation Reports

Subgrant agreement S322, Upper Bear River Stream Bank Stabilization, involved shaping banks, installing rock revetments, planting willows, installing 5,400 feet of exclusionary fencing, and grass seeding disturbed areas. This project was completed ahead of schedule with a close out report date of September 23, 2010.

Under subgrant agreement S335, Fish Haven Creek, a flume that acted as a fish barrier was removed and a permanent bridge for foot and ATV traffic was installed. This project was completed on schedule with a close out report date of February 11, 2010 (DEQ 2011).

Bear River §319 Subgrants in 2011 Evaluation Reports

Subgrant agreement S392, Upper Bear River Streambank Stabilization, sought to stabilize 1,000 feet of banks by resloping banks, installing rip rap and rock barbs, and planting vegetation. The newly planted willows were washed away in the high flows of 2011, but replanting was planned. The project was scheduled to be completed by December 31, 2014.

Subgrant agreement S402, Daniels Reservoir Sediment Reduction, included installing settling basins in cultivated fields, and developing 12 watering troughs and 8 miles of buried pipeline to bring water to cattle. This project was on schedule with a projected completion date of December 31, 2014 (DEQ 2012).

Bear River §319 Subgrants in 2012 Evaluation Reports

Subgrant agreement S189, St. Charles Creek Watershed Restoration, was reevaluated in 2012. This project was completed in 2010 and involved exclusionary riparian fencing along St. Charles Creek, water gaps, and water control head gates to control the flow of water from a wetland at the north end of Bear Lake. The water from a wetland that is grazed every winter used to be directly discharged into Bear Lake. Now it is treated in the wetland before discharge.

Subgrant agreement S207, Thomas Fork Streambank Stabilization on the Hillier Property, was reevaluated in 2012. This project reshaped and reestablished streambanks and riparian vegetation was planted.

Subgrant agreement S208, Thomas Fork Streambank Stabilization on the Boehme Property, was reevaluated in 2012. This project stabilized and planted streambanks on 3,200 linear feet of the Thomas Fork. This project was completed in 2010, and no deficiencies were observed during the evaluation.

Subgrant agreement S431, Bear River and Whiskey Creek, involved rerouting and stabilizing Whiskey Creek around a former dairy barn and existing manure stockpile area, installing a new pump and plumbing for livestock watering, installing exclusionary fencing, and installing pipeline to supply water to troughs. This project was scheduled to be completed by the end of May 2015 (DEQ 2013).

Bear River §319 Subgrants in 2013 Evaluation Reports

Subgrant agreement S431, Bear River and Whiskey Creek, was reevaluated in 2013. At the time of the evaluation, the project was scheduled to be completed by the end of December 2013.

Subgrant agreement S402, Daniels Reservoir Sediment Reduction, was reevaluated in 2013. The project was completed and finalized in 2013 and BMPs were being maintained (DEQ 2014b).

Bear River §319 Subgrants in 2014 Evaluation Reports

Subgrant agreement S434, Upper Bear River Streambank Restoration on the Peterson Property, was reevaluated in 2014. The project included rehabilitating 6,000 linear feet of riverbank through bank shaping and protecting the toe with woody plantings. Riparian fencing was installed to limit livestock access to the riverbank. The project was completed in 2013, and in 2014, BMPs were being maintained and monitoring performed.

Subgrant agreement S471, Station Creek Watershed Improvement, focuses on repairing washed out culverts, restoring streambanks, fencing the stream from livestock, providing off-stream water sources, and planting vegetation. In 2014, no BMPs had been installed because the Franklin SWCD had been waiting for project specifications from an engineer.

Subgrant agreement WW1010, Middle Bear River Watershed Mound Valley, involved bank restoration at two sites on the Bear River. Stream barbs were to be placed at two sites to direct flow away from a vertical bank.

Subgrant agreement WW1207, Ovid Creek Stream Protection, involved excluding livestock from two streams by fencing, relocating corrals, and installing watering troughs. The project was to be completed in fall 2014 at the time of the evaluation (DEQ 2015).

Table 45 provides all §319 projects completed since 2006 in the Bear River basin.

Table 45. §319 projects that have been completed since 2006 in the Bear River Basin (from Idaho 305B GID Data, ArcMap, and Dave Pisarski).

Project Name	Subgrant	Assessment Unit Number	BMP	Beginning Date	End Date	Budget
Upper Bear River Streambank Stabilization Project 11(2)	S461			8/20/2012	12/31/2016	54,350
Upper Bear River Streambank Stabilization	S392	ID16010102BR001_05	Streambank Restoration	7/1/2010	8/1/2012	24,970
Upper Bear R Streambank (Peterson Property)	S434	ID16010102BR001_05	Streambank Restoration	9/1/2011	3/10/2014	75,488
Upper Bear River Streambank Stabilization	S322	ID16010102BR001_05	Streambank Restoration	7/1/2009	2/29/2008	86,280
Bear River Streambank Restoration	S151	ID16010102BR001_05	Streambank Restoration	6/1/2005	2/29/2008	32,938
Bear River Basin WQ impr. Jenkins, Densmore, Weston, Pegram Creeks, Franklin	S221	ID16010102BR002_02	Riparian Habitat Improvement	10/3/2007	12/31/2007	59,163
Thomas Fork-Widmer Restoration	S108	ID16010102BR003_04	Streambank Restoration	9/30/2004	5/31/2006	50,000
Thomas Fork Stream Stable (HILLIER PROP)	S207	ID16010102BR003_04	Streambank Restoration	7/15/2007	3/8/2010	54,000
Thomas Fork Stream Stable (BOEHME PROP)	S208	ID16010102BR003_04	Streambank Restoration	7/15/2007	1/30/2012	46,000
Ovid Creek Stream Protection	WW1207		Fence, Heavy Use Protection, Pipeline, Pumping Plant, Stream Crossing, Watering Facility	3/15/2012	12/15/2015	84,375
PBJ Division	S495			9/6/2013	12/31/2016	123.857
Stauffer Creek Project	S528			10/24/2014	12/31/2017	186,361
Bear River Streambank Stabilization VALC.2013	S524			9/4/2014	12/31/2018	17,094
Bear River Dingle CAFO	S190	ID16010201BR002_05	Streambank Restoration	8/1/2006	2/24/2009	120,250
Hulme Ranch WQ Improvement	S334	ID16010201BR002_05	Pump Replacement	10/19/2009	12/31/2009	4,982
St. Charles Creek Watershed Restore	S189	ID16010201BR016_03b	Streambank Restoration	7/10/2006	2/9/2010	250,061
Fish Haven Crk Watershed Rest. Proj	S335	ID16010201BR019_02b	Fish habitat improvement	10/26/2009	1/29/2010	45,000

Project Name	Subgrant	Assessment Unit Number	BMP	Beginning Date	End Date	Budget
Station Creek Watershed Improvement	S471			10/17/2012	12/31/2016	125,008
Middle Bear River Watershed Mound Valley	WW1010			2/1/2013	5/30/2016	248,804
Trout Creek AFO	WW1201					
Bear River AFO Proj, Mid Bear Subbasin	S296	ID16010202BR007_03	Livestock Control Projects	4/24/2009	2/12/2010	121,302
Bear River & Whisky Creek AFOs	S431	ID16010202BR012_02	BMP Design/Implementation	8/15/2011	6/12/2015	212,615
Wide Hollow Erosion Reduction	S496			9/10/2013	12/31/2017	249,750
Daniels Res. Sediment Reduction	S402	ID16010204BR009_02	Erosion Control Projects	7/20/2010	9/9/2013	170,329
Wrights Creek Stream Restoration	S150	ID16010204BR010_04	Streambank Restoration	5/30/2005	12/30/2006	12,390

NRCS Projects

The NRCS has been working in the Bear River basin on a variety of projects that install BMPs and adopt grazing and nutrient management plans. Below is a summary of practices that have been implemented by NRCS in the basin since 2009.

In the Central Bear subbasin (HUC 16010201), the NRCS has completed 133 acres of brush management, 21,116 feet of riparian fencing, 1,865 acres of weed control, 23,241 feet of conveyance pipe, 653 acres of irrigation systems, 638 acres of irrigation water management, 382 acres of nutrient management, 22,023 feet of livestock pipeline, 6,937 acres of prescribed grazing, 12 pumping plants, 4 springs development, 3 stream crossings, 13 structures for water control, 3 wells, and 27 off-site water developments.

In the Thomas Fork (ID16010201BR003_04), the NRCS has completed 727 acres of weed control, 2,350 feet of livestock pipeline, 3,800 acres of grazing management, 1 pumping plant, 2 spring developments, and 4 off-site water developments.

In the Bear Lake subbasin (HUC 16010201), the NRCS has completed projects on Georgetown, North, Montpelier, Ovid, St. Charles, and Stauffer Creeks. On Georgetown Creek, the NRCS completed 3,800 feet of channel restoration, 3,530 feet of riparian fence, 2 acres of riparian planting, 2,532 feet of channel stabilization, 15 cfs fish screen, and hundreds of tree and shrub planting. On North Creek, the NRCS has completed 25 acres of brush management, 2,300 acres of fence, 3,200 feet of livestock pipeline, 1 spring development, 28 acres of weed control, 2 off-site water developments, and 1 pumping plant. In the Montpelier Creek watershed, 2 structures for water control, 1 pumping plant, and 5,650 feet on conveyance pipe were installed. In the Ovid Creek watershed, 18,650 feet of fence, 1,214 acres of weed control, 280 acres of irrigation system, 5,630 feet of conveyance pipe, 290 acres of irrigation water management, 2,350 feet of livestock pipeline, 1,625 acres of prescribed grazing, 2 pumping plant, 1 waste storage facility, and 13 off-site water developments were completed. Along St. Charles Creek, 30 acres of riparian areas were excluded from grazing. In the Stauffer Creek watershed, 1,670 acres of grazing management were completed.

In the Middle Bear subbasin (HUC 16010202), the NRCS has worked on projects along the Bear River and on tributary watersheds including Whiskey, Trout, and Densmore Creeks. On Whiskey Creek, 9,450 feet of channel restoration, 71 instream pools, 2,800 feet of riparian fence, 5 acres of wetland habitat, 2 instream ponds for wildlife, 5 acres of riparian plantings, hundreds of tree and shrub plantings, 31 acres of livestock use exclusion, 2 off-site water developments, and 7,400 feet of irrigation pipe have been installed. Additionally, 116 acres of grazing plans have been completed. On Trout Creek, 3,550 feet of channel restoration, 22 instream pools, 1,230 feet of riparian fence, 5 acres of riparian planting, 9 acres of wetland enhancements, hundreds of tree and shrub plantings, and 12,500 feet of irrigation pipe were installed. An animal waste pond was removed. Also, 10 acres received weed treatment, 105 acres received grazing plans, and 5 acres were treated with livestock use exclusion. In the Densmore Creek watershed, grazing plans are being followed on 1,130 acres.

Along the Bear River in the northern section of the Middle Bear subbasin (HUC 16010202), the NRCS has installed several BMPs. Twelve acres have been treated with wetland habitat management, 66 acres with livestock use exclusion, 540 acres with weed control, 830 acres with grazing plans, 1,127 acres with nutrient management plans, and 1,800 acres with irrigation water management. Additionally, 13,890 feet of channel protection/restoration, 42,000 feet of riparian fence, hundreds of tree and shrub plantings, 12 off-site water developments, 15,767 feet of livestock pipeline, 1 well and spring development for livestock water, 5 pumping plants, and 47,400 feet of conveyance pipe have been installed in this region.

4.8 Future Strategy and Time Frame

DEQ will continue to work with landowners and federal and state agencies to improve water quality in the Bear River basin. To address sediment pollution, the major concern in the watershed, BMPs must be implemented on private land more aggressively. DEQ should use §319 funds to improve stream conditions on private land. Additional management strategies should be implemented so that AUs with TMDLs are moving towards support of beneficial uses. This support will be assessed by DEQ's ambient water quality monitoring program (BURP) and other water quality measurements taken by DEQ.

5 Summary of Five-Year Review

5.1 Review Process

For the 5-year review, DEQ data were the primary source of information. BURP data were used to assess the current biological condition of AUs included in the Bear River basin TMDL (DEQ 2006a). Tri-state monitoring data (2006–2015) were used to assess if TMDL targets for TSS and TP were being achieved at sites along the Bear River in Idaho. In 2015, a riverbank erosion inventory was conducted by DEQ along 105-miles of the Bear River in Idaho. Additionally, water quality data were collected at tributary locations under the 2006 TMDL. Annual reports (2007–2014) from DEQ's Nonpoint Source Management Program were reviewed to document §319 projects that took place in the Bear River basin. Implementation plans were reviewed and the Caribou-Targhee National Forest and NRCS provided information on TMDL implementation projects in the basin.

5.2 Changes in Subbasin

The Bear River basin in Idaho includes portions of Bear Lake, Caribou, Franklin, and Oneida Counties. Bear Lake and Caribou Counties slightly decreased in population between the 2000 and 2010 census while Franklin and Oneida Counties grew. A Settlement Agreement for relicensing of PacifiCorp Bear River Project was approved by the Federal Energy Regulatory Commission in 2003. As part of this agreement, the Cove Power Plant in the Middle Bear subbasin (HUC 16010201) was decommissioned in 2006. The ECC made up of signatories to the Settlement Agreement have approved the funding of 8 to 12 habitat enhancement projects annually and have purchased conservation easements for conservation in Caribou and Franklin Counties. Implementation projects have been completed under §319 of the Clean Water Act, by the NRCS and Caribou-Targhee National Forest.

In most cases, AUs under the TMDL are not supporting beneficial uses such as cold water aquatic life and contact recreation. BURP data did, however, identify nine AUs that are supporting cold water aquatic life and should be removed from Category 4a and placed in Category 2 if they are not on the §303(d) list for other pollutants. Many of these AUs are headwater segments to streams in the Bear Lake subbasin (HUC 16010201): Upper Bailey Creek (ID16010201BR003_02a), Upper Eightmile Creek (ID16010201BR004_02), North and South Forks Stauffer Creek (ID16010201BR006_02c), Stauffer Creek (ID16010201BR006_02d), North and South Forks Skinner Creek (ID16010201BR007_02a), and Upper Georgetown Creek (ID16010201BR022_02b). In the Middle Bear subbasin (HUC 16010202), Upper Maple Creek (ID16010202BR003_02a) was in Category 4a for *E. coli*. The 2015 data indicate that water quality standards are being met, and BURP data indicate that cold water aquatic life is being fully supported. This AU should be placed in Category 2 in the next Integrated Report. Birch Creek (ID16010202BR007_02) was included in the 2006 TMDL for TSS and TP. BURP data indicate that cold water aquatic life is fully supported, and 2015 water quality sampling indicated that TMDL targets are being met. Indian Mill Creek (ID16010204BR010_02a) in the Lower Bear/Malad subbasin (HUC 16010204) was under the 2006 TMDL for TSS and TP. Like Birch Creek, BURP data indicated that cold water aquatic life is being supported, and 2015 sampling indicates that TMDL targets are being met. Both AUs should be placed in Category 2 in the next Integrated Report.

5.3 TMDL Analysis

The Bear River/Malad River TMDL (DEQ 2006a) included targets for sediment and nutrients. Since phosphorus was the excess nutrient in most water bodies impaired by nutrient pollution, TP targets were developed. For water bodies that flow into other streams or rivers, the TP target was 0.075 mg/L. For water bodies that flow into a lake or reservoir, the TP target was set at 0.05 mg/L. Since nitrogen was determined to also be in excess in Thomas Fork (ID16010102BR003_04), a TN target was established at 0.85 mg/L. Targets for TSS were stratified into runoff and base flow conditions. During runoff, TSS was not to exceed 80 mg/L for streams flowing into other streams and 60 mg/L for streams flowing into a lake or reservoir. During base flow, TSS was not to exceed 60 mg/L for streams flowing into other streams and 35 mg/L for streams flowing into a lake or reservoir. *E. coli* bacteria limits were set at the water quality criteria of a 5-sample geometric mean of 126 colony forming units (cfu)/100 mL of water.

TMDL targets have mostly have not been achieved in the Bear River basin due to lack of adequate implementation. Other factors such as lack of perennial flow due to irrigation withdraws are also impacting beneficial uses in many AUs in the basin. In addition, implementation practices that have been put in place and maintained may not have had sufficient time for hydrologic and biologic processes to fully recover those stream reaches. Table 46 summarizes recommended changes for the AUs reviewed.

Table 46. Summary of recommended changes for AUs reviewed.

Stream Name	Assessment Unit Number	Pollutant	Recommended Changes to Next Integrated Report	Justification
Upper Bailey Creek	ID16010201BR003_02a	TP and TSS	Move from Category 4a to Category 2.	BURP scores indicate full support of CWAL. 2015 water quality sampling indicates that TMDL targets are being achieved.
Upper Eightmile Creek	ID16010201BR004_02	TP and TSS	Move from Category 4a to Category 2.	BURP scores indicate full support of CWAL. 2015 water quality sampling indicates that TMDL targets are being achieved.
North and South Forks Stauffer Creek	ID16010201BR006_02c	TP and TSS	Move from Category 4a to Category 2.	BURP scores indicate full support of CWAL. 2015 water quality sampling indicates that TMDL targets are being achieved.
Stauffer Creek	ID16010201BR006_02d	TP, TSS, and *E. coli*	Keep listed in Category 5 for *E. coli* and move CWAL to Category 2.	BURP scores indicate full support of CWAL. 2015 water quality sampling indicates that TP and TSS TMDL targets are being achieved.
North and South Forks Skinner Creek	ID16010201BR007_02a	TP and TSS	Move from Category 4a to Category 2.	BURP scores indicate full support of CWAL. 2015 water quality sampling indicates that TMDL targets are being achieved.
Upper Georgetown Creek	ID16010201BR022_02b	TP, TSS, and selenium	Keep listed in Category 5 for selenium and move from Category 4a to Category 2 for TP and TSS.	BURP scores indicate full support of CWAL. 2015 water quality sampling indicates that TMDL targets are being achieved.
Upper Maple Creek	ID16010202BR003_02a	*E. coli*	Move from Category 4a to Category 2.	2015 *E. coli* geometric mean = 6 cfu/100 mL. TMDL targets are being achieved and recreational beneficial use is fully supported.
Birch Creek	ID16010202BR007_02	Combined biota/habitat bioassessments, TP, and TSS	Move from Category 4a to Category 2 for CWAL and delist from Category 5 for combined biota/habitat bioassessments.	BURP scores indicate full support of CWAL. 2015 water quality sampling indicates that TMDL targets are being achieved.
Indian Mill Creek	ID16010204BR010_02a	TP and TSS	Move from Category 4a to Category 2.	BURP scores indicate full support of CWAL. 2015 water quality sampling indicates that TMDL targets are being achieved.

Notes: total phosphorus (TP), total nitrogen (TN), *Escherichia coli (E. coli);* Beneficial Use Reconnaissance Program *(*BURP); cold water aquatic life (CWAL); colony forming unit (cfu); milliliter (mL)

5.4 Review of Beneficial Uses

Some AUs in the Bear River basin have designated beneficial uses in Idaho's water quality standards. Designated beneficial uses include cold water aquatic life, salmonid spawning, primary and secondary contact recreation, and domestic water supply. Other AUs do not have designated beneficial uses. When beneficial uses are not designated, DEQ presumes they should support cold water aquatic life and recreation. In the most recent Integrated Report (DEQ 2014a), just 34 of 242 AUs in the Bear River basin are included as fully supporting beneficial uses. DEQ may propose designating some AUs (after appropriate consultation with the Bear River Basin Advisory Group) for salmonid spawning using the report, *Geography and Timing of Salmonid Spawning in Idaho* (Miller et al. 2014).

5.5 Water Quality Criteria

No water quality criteria have changed that affect the Bear River/Malad River TMDL (DEQ 2006a). AUs received TMDLs for pollutants that only have narrative water quality criteria. It is likely in certain reaches of the Bear River to meet TP targets adjustments may need be made to the TSS targets. More research is likely needed to assess the relationship between phosphorus sources and TSS in various reaches. Until those information are available, DEQ recommends continued implementation of BMPs. These BMPs should remain focused on reducing sediment delivery to the tributaries and main stem river as well as reducing nutrient sources such as wintertime AFOs that deliver excess nutrients to tributaries and the main stem river.

5.6 Basin Advisory Group Consultation

The Bear River basin advisory group (BAG) consists of 11 members, one each representing agriculture, environment, forestry, hydropower, livestock, local government, mining, nonmunicipal NPDES, representative at large, Shoshone-Bannock Tribes, and water-based recreation. This 5-year TMDL review has been presented to the Bear River BAG (October 2015), ECC charged with implementing PacifiCorp's Bear River project Federal Energy Regulatory Commission Hydropower license (February 2016), and Bear River Water Quality Committee of the Bear River Commission (April 2016).

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